CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

Environmental Management and Sustainability Program Innovation Initiative

Report on the Cal/EPA Environmental Management System Project

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"Great things are not done by impulse, but by a series of small things brought together."
- - Vincent Van Gogh

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Cal/EPA Environmental Management System Project
Public Report:
Executive Summary

I. Background

The quest for a sustainable world began two decades ago with the work of the *United Nations World Commission on Environment and Development*. The Commission's report "Our Common Future", published in 1987, identified worldwide pressures and proposed actions that would foster sustainable development. Then in 1992, 172 nations participated in *The United Nations Conference on Environment and Development* in Rio de Janeiro, Brazil. Significantly, one result of the conference was the adoption of a comprehensive set of guidelines, Agenda 21, for achieving a sustainable global environment. Another result of the conference was the international business community's support for the development of standardized management systems for environmental protection. By 1996, the International Organization for Standardization (ISO) developed the "Standard for Environmental Management Systems", or ISO 14001 as it is most commonly called. From ISO 14001 has emerged an environmental management system (EMS) approach to managing and preventing pollution in regulated and non-regulated enterprises.

In 1998, the California Environmental Protection Agency (Cal/EPA) established an *Innovation Initiative* as a response to the growing international interest in achieving a sustainable global environment. It joined with U.S. EPA, non- governmental organizations (NGOs), business, academia and other states as a member of the Multi-State Working Group (MSWG) to study the environmental benefits of EMS as a tool for enhancing environmental protection and achieving sustainable development. The MSWG participants and observers presently include all 50 states, several of which are actively engaged in approximately 50 EMS pilot projects.

Because of the significant policy implications of the *Innovation Initiative*, the Legislature authorized the Cal/EPA to establish up to eight pilot projects with which to evaluate the potential of EMS in California. This executive summary describes the findings, conclusions, and recommendations resulting from the *Environmental Management System Project* (EMS Pilot Project) as prescribed in Assembly Bill 1102 (Stats. 1999, Ch. 65) codified in Public Resources Code (PRC), Section 71045 et seq. (AB 1102), which sunset on January 1, 2002.

II. Pilot Project Goal

The EMS Pilot Project goal is to understand whether and how EMSs can help improve public health and environmental protection in California.

III. Pilot Project Objectives

The objectives of the EMS Pilot Project as specified by law are to evaluate:

1. Whether and how the use of an environmental management system (EMS) by a regulated entity increases public health and environmental protection over their current regulatory requirements [1] and;
2. Whether and how the use of an EMS by a regulated entity provides the public greater information on the nature and extent of public health and environmental effects than information provided by their current regulatory requirements[2].

To the above, Cal/EPA added the following objectives:

3. Evaluate economic indicators to determine incentives and barriers to EMS implementation.
4. Identify challenges and successful examples of EMS implementation.

Each of the pilot projects may identify additional project specific objectives that characterize unique aspects of a pilot's EMS.

IV. What is an EMS?

An environmental management system (EMS) is a voluntary management process designed to help an organization meet environmental objectives and achieve and demonstrate improved environmental performance. An EMS employs a systems approach[3] to environmental management by providing a comprehensive review of an organization's operations to identify and manage or lessen the environmental impacts of operations, to maintain regulatory compliance, and to identify opportunities and create practices for more efficient use of raw materials and resources. It is a process of continual improvement and, as such, results must be monitored and reported frequently to determine the effectiveness of the process and the need for system adjustments. Understanding the actual practice of EMS implementation and its ability to better protect public health and the environment is the purpose of the Cal/EPA EMS Pilot Project.

There are several models for EMSs. In 1996 the International Organization for Standardization (ISO), a non-governmental international organization based in Geneva, Switzerland, developed the "Standard for Environmental Management Systems", or ISO 14001 as it is most commonly called. In the United States, organizations can elect to

[1] Protection provided by current regulatory requirements is defined as those protections provided through the issuance, enforcement, and monitoring of any permit, requirement, authorization, standard, certification, or other approval issued by a federal, state, regional or local agency to the regulated entity for the protection of the public heath or the environment (PRC § 71046(a)(1)).

[2] Information provided by current regulatory requirements is defined as that information provided through the issuance, enforcement, and monitoring of any permit, requirement, authorization, standard, certification, or other approval issued by a federal, state, regional or local agency to the regulated entity for the protection of the public heath or the environment, or any other law or regulation governing the disclosure of public information (PRC § 71046(a)(2)).

[3] An accepted definition of a system is "a set of elements in dynamic interaction, organized for a common goal." Through the implementation of an EMS, an organization operates a system with the goal of improved environmental protection.

be certified (registered) to the ISO 14001 Standard by an independent auditor registered by the American National Standards Institute Registration Accreditation Board (ANSI RAB).

From ISO 14001 has emerged an environmental management system (EMS) approach to managing and preventing pollution in regulated and non-regulated enterprises. It is important to understand that ISO 14001 certification is given to the *process* not the results. Results must be measured and evaluated externally by regulators for compliance and internally by management for other environmental objectives such as resource use efficiencies. The ISO 14001 Standard however, requires that the organization's processes for environmental protection continually improve. Process improvements are assumed to lead to better environmental performance results, such as improved compliance and/or the conservation of resources. This assumption is tested in the Cal/EPA EMS Pilot Project. The continual improvement nature of an EMS may create a nexus between the EMS process, the regulatory system, and the long-term environmental societal goal of an improving environment.

An EMS provides a systems framework for a process that includes a continuous cycle of planning, implementing, reviewing, and improving the actions an organization takes to meet its business objectives and environmental obligations. The Plan-Do-Check-Act (or Adjust) cycle broadly outlines the systems approach of an EMS. This cycle establishes a feedback loop that may help drive continual improvement in environmental protection.

V. Project Design and Methodology

This section describes the requirements and elements of project design as well as methodology for implementing pilot projects, collecting data, analyzing data and establishing conclusions.

A multi-disciplinary team, administered through the Office of the Secretary, managed the EMS Pilot Project. Team members from the Air Resources Board, Department of Toxic Substances Control, Integrated Waste Management Board, and State Water Resources Control Board served as project managers for the pilot projects.

Phase I –Pilot Project Development

Phase I of the project consisted of identifying and soliciting stakeholders, including business, government, academia, and non-governmental organizations, to participate in workshops to design the project, the criteria by which pilots would be selected, data collection protocols, and Pilot Project Work Plans. Two Working Groups, one in Northern California and one in Southern California, were established in 1999. Also, Local Working Groups for individual pilot projects were encouraged. Several workshops were conducted to involve stakeholders directly in the development of pilot project

selection criteria, Pilot Project Work Plans, and Evaluation and Monitoring Parameters data collection protocols). Two public hearings were conducted in May 2000 and the following seven pilot projects were selected.

- Anheuser-Busch, Incorporated, Fairfield (A-BI)
- Two publicly owned wastewater treatment facilities: Central Marin Sanitation Agency in San Rafael (CMSA); San Diego Metropolitan Wastewater Department, Operations and Maintenance Division, San Diego (San Diego)
- IBM Corporation, San Jose (IBM)
- Lockheed Martin Aeronautics Company, Palmdale (LM Aero - Palmdale)
- Two metal finishing facilities: Artistic Plating, Anaheim (Artistic); Gene's Plating, Los Angeles (later removed from the project)
- Pentel of America, Ltd., Torrance (Pentel)
- Two Sonoma County wineries: Davis Bynum Winery; Benziger Family Winery (Wineries)

Phase II – Data Collection, EMS Education

The second phase of the pilot project involved collecting data on EMS implementation from pilot projects using the Evaluation and Monitoring Parameters as well as facility visits. A series of four educational workshops given in both Northern and Southern California, funded by a US EPA grant, provided a basic understanding of EMSs for all stakeholders.

Evaluation and Monitoring Parameters selected for the EMS Project consist of the National Database on Environmental Management Systems Data Protocols (National Database) and the Supplemental California Protocols. The National Database was developed by the Multi-State Working Group on EMS and funded by the US EPA. The Database is used to collect standardized information on EMSs from pilot projects all over the United States. The National Database Protocols can be downloaded from the Environmental Law Institute web site (http://www.eli.org/isopilots.htm). Because of the specific information requirements of AB 1102 (Stats. 1999, Ch. 65), PRC § 71045 et. seq., Cal/EPA created supplemental data protocols to be used only in the California pilot projects. The California Protocols are included in Appendix K. Each of these Evaluation and Monitoring Parameters is described in more detail below.

The National Database is the primary data set for the Cal/EPA EMS Pilot Project. Information was collected using three protocols: baseline, EMS design and update.

The baseline protocol required three years of pre-EMS environmental performance data as well as information on pre-EMS environmental programs like pollution prevention. Baseline and update protocols collected information regarding management systems; environmental performance; compliance; pollution prevention; interested party involvement; and economic performance.

Information on the design of the pilots' EMS provided information about specific elements of the EMS such as environmental aspects[6] and impacts, objectives and targets, EMS audits, and management review.

In order to measure the effect of EMS implementation on the pilot projects' environmental performance and management, up to two years of post-EMS data were collected. The update protocols revisit each of the data categories collected in the baseline and design protocols.

The supplemental California Protocols were created to address specific data needs of the Cal/EPA EMS Project not addressed by the National Database. A primary purpose was to answer whether and how an EMS provides greater environmental information to the public than that provided by the current regulatory system. The California Protocols also sought information on whether and how pilot EMSs met or exceeded environmental regulatory requirements.

Data collection and EMS education were also accomplished through stakeholder site visits at each of the pilot project facilities. These on-site Working Group meetings facilitated dialogue between pilot project participants, Cal/EPA and stakeholders regarding pilot facility EMS design and implementation. During these meetings, pilot organizations shared information on EMS implementation, led a facility tour, answered questions, and received feedback from stakeholders on their EMS design and implementation.

Phase III – Data Analysis and Methodology

The final phase of the EMS Project involved analysis of the data and establishing the conclusions of the project. The evaluation of each pilot project is described in pilot study reports (Appendices A through H). Data analysis was conducted to determine whether and how the use of an EMS:

- by a regulated entity increases public health and environmental protection over their current regulatory requirements and;

[6] An environmental aspect is defined in ISO 14001 as an element of an organization's activities, products or services which can interact with the environment. A significant environmental aspect is an environmental aspect which has or can have a important environmental impact.

[8] Within the context of environmental protection, the term "command and control" is used to describe regulating pollution at the point of discharge by setting limits on how much pollution will be tolerated. Hence we "command" a maximum acceptable limit and "control" pollution at the point of discharge.

- provides the public greater information on the nature and extent of public health and environmental effects than information provided by their current regulatory requirements.

To determine whether and how improved environmental protection resulted from EMS implementation, Cal/EPA evaluated three primary categories of information from each pilot project, these being improvements in: 1) awareness and commitment; 2) systems management of environmental impacts; and 3) performance for key environmental indicators.

The provision of greater environmental information was measured by evaluating the type, relevance, and accessibility of the information. The level of involvement the receiving audience has in the information's creation can also indicate greater information. Therefore Cal/EPA analyzed: 1) public access to information about the EMS, environmental impacts and environmental performance; and 2) public and stakeholder involvement in EMS development, implementation and review.

Pilot study analysis also supports findings and conclusions related to other objectives of the EMS project including economic costs and barriers of EMS implementation, challenges and successes in EMS implementation, and any specific objectives identified in the individual Pilot Project Work Plans.

VI. Project Description Summaries

The Legislative Report includes summaries of each pilot project. Pilot study Reports are included in Appendices A through H.

VII. Analysis

Objective 1: Determine whether and how the use of an EMS by a regulated entity increases public health and environmental protection over their current regulatory requirements.

Increased environmental protection as a result of EMS implementation can be identified three ways. First, a pilot may perform greater than legally mandated requirements (as in discharge requirements). Second, a pilot may mitigate environmental impacts not covered by law and regulation. Third, a pilot may improve their level of environmental protection above that provided prior to EMS implementation. The first two measures are consistent with AB 1102 (Stats. 1999, Ch. 65) PRC § 71045 et seq., while the last measure is needed to understand whether an EMS has helped change the level of environmental protection at an organization**.**

The Cal/EPA EMS pilot project measured environmental protection by evaluating three indicators: awareness and commitment; systems for environmental protection; and environmental performance. Each indicator provides a different measure of environmental protection, with awareness and commitment and systems management of environmental impacts being leading, or predictive indicators of improved protection, while environmental performance is a more direct indicator. Determining 'how' an EMS

can improve environmental protection is accomplished by analyzing the processes of organizational change at the pilots. These processes include increasing awareness and commitment, tying commitment to individual and shared responsibility, and creating improved systems for environmental management.

Awareness and Commitment

Awareness and commitment are indicators of environmental protection because they describe a pilot's knowledge and understanding of environmental impacts and recognition that action is necessary to lessen impacts and improve environmental protection. They are, however, only leading or predictive indicators of improved protection. Elements of EMSs that were observed to increase awareness and commitment include the Environmental Policy; aspect and impact identification; identification of legal and other requirements; and setting of objectives and targets.

Three basic commitments are expressed in environmental policies; commitments to compliance, prevention of pollution and continual improvement. The environmental policies also served to increase employee awareness of their responsibility in protecting public health and the environment. These types of statement were often not present prior to EMS implementation. Commitments often went beyond legal requirements; for example commitments to the reduction of waste and the conservation of resources.

An environmental aspect is an element of an organization's activities products, or services that can interact with the environment. Significant aspects are those activities that can have a serious impact on the environment. An organization is responsible for identifying their significant aspects and in so doing raise awareness of their environmental impacts. Organizations registered to ISO 14001 are required to manage all significant aspect. Many significant aspects are activities that are not regulated like the use of energy and water, solid waste generation, or employee transportation. Through the management of non-regulated aspects organizations can increase protection of non-regulated impacts.

EMS implementation helped many pilots increase their knowledge of legal requirements. For example, to create a regulatory checklist and procedure for updating knowledge of legal requirements in fulfillment of ISO14001, Pentel invited environmental regulators into the factory to inspect the facility and its operations. As a result, Pentel became aware of air, water, and toxic rules. Upon becoming aware of these requirements, Pentel made the changes needed to comply and implemented a regulations compliance database.

Objectives and targets are another measure of commitment by identifying what an organization is committed to achieve and by when. The following are some findings related to the objectives and targets of the pilot projects.

- The majority of objectives are set for non regulated activities.
- Many pilots set pollution prevention objectives for hazardous waste, and while hazardous waste is regulated, there are no limits regarding its generation.

- Some objectives exceeded regulatory management requirements, for example establishing standard operating procedures.
- Only one pilot, Artistic Plating, specifically set objectives to exceed mandated performance limits.
- Most pilots met many of their objectives; however, a considerable number of objectives were not met.

Environmental Performance tables located immediately after the executive summary identify primary objectives and targets for each pilot and their status.

Systems for Managing Environmental Impacts

Systems Management of Environmental Impacts refers to the ability of an organization to better protect the environment through more mature and effective systems of environmental management. This refers to the programs and processes an organization uses to meet regulatory requirements, follow their environmental policy, make progress towards objectives and targets, measure and review performance, and adjust to foster continual improvement. To identify improvements in management systems Cal/EPA analyzed the relationships between the environmental policy, significant aspects, objectives and targets and other elements of an EMS that act within the Plan-Do-Check-Act cycle. Also analyzed were the implementation programs, processes for monitoring and measurement of environmental performance, and processes for review, corrective action and continual improvement. This analysis helps in understanding whether an EMS can improve environmental protection by illustrating more effective systems of environmental management and in doing so help identify 'how' an EMS can improve public health and environmental protection.

Improved systems for managing environmental impacts were observed in many of the pilot projects. Implementing the Plan-Do-Check-Act EMS cycle is one system element that effectively promoted improved public health and environmental protection. Other system elements that were found to improve environmental protection include increased monitoring and measurement, operational controls, communication, training and specified environmental job responsibilities. Systems for compliance assurance included some or all of the following elements: improved monitoring, internal and external audits, management review, root cause analysis, corrective action, and preventive action. Pilot projects with mature EMSs created systems for continual improvement that included performance measurement, internal and external audits, management review, corrective action, and new objective setting. Information technology played an important role in implementing, maintaining, and improving EMSs at the larger facilities with mature EMSs.

Environmental Performance Indicators

Performance data provided by the pilot projects reveal several trends in environmental performance improvement. Pilots who are still in the process of implementing their EMS have not reported gains in environmental performance improvement. The Sonoma County Wineries and CMSA are establishing their management programs

even though objectives have been set. San Diego and Pentel, however, are experiencing significant improvements and still show great potential for future gains. The pilots with mature EMS on the other hand, Anheuser-Busch, IBM and LM Aero – Palmdale show signs of reaching performance limits. Since 1991 LM Aero – Palmdale has reduced hazardous waste generation by 91 percent; however, the rate of hazardous waste reduction at LM Aero – Palmdale has significantly slowed. LM Aero - Palmdale now direct efforts at eliminating problem chemicals, rather than simply reducing the use of those chemicals. At Anheuser-Busch environmental performance indicators like wastewater flow and load, hazardous waste, fuel and energy use remained relatively stable during the project period. Anheuser-Busch, however, has been focusing on improving performance since the 1980s and has achieved significant environmental performance including a 98.3 percent recycling rate. IBM had been able to increase efficiency; however, performance metrics have also remained relatively stable.

The Environmental Performance Summary Table, located after this Executive Summary, reports the performance of pilots towards meeting their principal objectives and targets. The table also identifies whether regulatory requirements exist for the objective or whether the objective proposes to meet or exceed regulatory requirements. The table also summarizes the overall environmental accomplishments of the pilot's EMS.

A comparison of environmental performance against regulatory limits was used to determine whether increased environmental performance beyond current regulatory requirements resulted from EMS implementation. Local pretreatment requirements and performance data were available for three pilots: Artistic Plating, IBM, and LM Aero – Palmdale. Analysis determined that average monthly discharge levels at each pilot were substantially below permitted levels. However, only Artistic Plating set objectives to specifically better there regulatory limits. Artistic Plating set an objective to reduce cyanide concentrations in wastewater discharge 50% below their permitted levels and reduce chromium by 10% over the 2000 monthly average. These goals were set to provide a compliance buffer and help ensure that Artistic would not exceed permit limits. IBM on the other hand considered these aspects under operational control, within limits and properly managed and therefore did not set any performance objectives. LM Aero – Palmdale's objective is to maintain compliance with their permits.

While no clear trend in compliance improvements was observed in the EMS project, many pilots had a better recognition of, and response to, compliance issues. In some cases, pilots who had no violations before the EMS was put in place, such as IBM, continued to have no violations afterwards. In other cases, pilots who had violations before the EMS, such as Artistic, had some violations after the EMS was put in place, but had better systems in place to respond to problems swiftly.

Compliance methodology consisted of documenting violations whenever regulatory inspections were conducted at the pilots. Special inspections were not requested as part of the pilot project. However, in the case of Pentel, the company sought a

regulatory inspection on their own accord, in order to identify any deficiencies and understand all their requirements.

Objective 2: Determine whether and how the use of an EMS by a regulated entity provides the public with greater information on the nature and extent of public health and environmental effects of their activities or processes than their current regulatory requirements.

To meet this objective Cal/EPA first established a general baseline for environmental reporting requirements and evaluated whether these provide information on the nature and extent of public health and environmental effects. Access to this information was also analyzed. The nature of public health and environmental effects are the intrinsic characteristics or qualities of the environmental impacts of the organization's actions. These qualities can include source, cause, type, quantity, severity, or risk. The extent of public health and environmental effects is the range or scope of the environmental impacts of the organization's actions.

The regulatory baseline for public information are those public reporting requirements that provide the public with information on the nature and extent of the public health and environmental effects of their activities or processes. Regulatory requirements evaluated included Air Toxics "Hot Spots", Prop 65 (Safe Drinking water and Toxic Enforcement Act of 1986), the federal Emergency Planning and Community Right-to-Know Act, federal Toxic Release Inventory (TRI), and California Hazardous Materials Business Plans. Each of these requirements provides information on the nature of effects; however, only the Toxic "Hot Spots" begins to define extent of impacts. Toxic "Hot Spots" is the only requirement that provides direct information to the public. Proposition 65 provides generic warnings and TRI data is posted on the Internet.

The EMSs evaluated in this pilot project generated new and useful information on the nature and extent of impacts not required by law or regulation. EMSs proved better in providing information on the nature of impacts than on extent. The environmental policy, for example, begins to describe the nature of their impact and a commitment to reduce that impact. Through the aspect and impact identification process, pilots identified local, regional, and global impacts of specific activities, thus providing information on the nature of impacts and in general on the extent of those impacts. Objectives, targets, and performance measures identify commitments to improve environmental protection and progress made towards those commitments. Internally this information is critical to the effectiveness of an EMS. Externally it can improve public understanding of the nature and extent of the public health and environmental effects of an organization's operation. This type of information was openly shared with the Cal/EPA sponsored Working Groups.

Improved access to information is another measure of greater information. The Internet and Annual Reports were seen as new ways for communicating environmental and public health information to the public. Although the pilots (Anheuser – Busch and IBM) that used these media for information sharing consolidated information at the corporate

level, considerable information is provided through these avenues including compliance information, EMS policies, and performance data. In order for these avenues to provide more meaningful public information, local data needs to be included as well as data on specific impacts and commitments for lessening those impacts.

Public involvement in EMSs can indicate greater information sharing. Pilots willingly shared environmental information with the stakeholder working groups including EMS information and performance data. Pilots invited stakeholders into their facilities and provided EMS overviews and facility tours. Seeing the value of EMSs, the CMSA Local Advisory Group effectively lobbied for the continuation of CMSA's at a time when the future of CMSA's EMS was in question.

One pilot, LM Aero – Palmdale exceeded the Hazardous Materials Business Plan requirements by giving seminars and plant tours to emergency responders. LM Aero – Palmdale hopes that this information will improve safety by providing emergency responders with first hand information on risks at the plant, rather than emergency responders only relying on the written Hazardous Material Business Plan.

While significant improvements in environmental communication were observed through the EMS Pilot Project these improvements were limited in either the scope of information or access to that information. Pilots willingly shared EMS information with the stakeholder work groups, which did include public members; however, the general public did not have this same access. The use of the internet can provide the general public with better access; however, corporate web sites, with the exception of LM Aero – Palmdale, do not provide local facility information. EMSs, however, have the potential for greatly improving the type of information generated and access to that information. Involving stakeholders will be critical in developing information systems that provide relevant and accessible information.

Objective 3: Evaluate economic indicators to determine incentives and barriers to EMS implementation.

The potentially significant cost savings resulting from EMS implementation can provide incentive for organizations implementing EMSs. LM Aero – Palmdale saved over $1 million per year between 1992 and 1999. Artistic Planting is projected to save $116,896 per year due to EMS implementation, allowing the hiring of an additional waste water treatment operator. These savings resulted primarily from increased efficiency in the use of resources and materials. Water, energy, materials and waste all have economic costs associated with them.

EMSs also require economic investment. Although specific costs were not provided, EMS implementation required considerable amount of personnel hours and could include consultant fees. EMSs could also highlight the need for spending on new processes and operations. Long pay back periods could act as a barrier to EMS implementation, especially for small companies. The Artistic Plating example, however, indicates that substantial savings can accelerate return on investment.

Objective 4: Identify challenges and successful of EMS implementation.

Challenges and success of EMS implementation were observed in several areas including leadership and commitment; strains on resources; integration of EMS into the organization; technical complexity and assistance; goal setting, measurement and feedback; and stakeholder involvement. Challenges can be thought of as barriers or inhibitors of improved environmental protection. Successes demonstrate activities that promote improved environmental protection. Table 1 below summarizes promoters and inhibitors of EMS implementation.

Table 1: Promoters and Inhibitors of EMS Implementation

Promoters	Inhibitors
Strong management commitment to EMS implementation and improved environmental protection.	Weak management support of EMS implementation and acceptance of status quo in environmental protection.
The presence of champions, in either management or staff.	Apathy or resistance to EMS implementation in management or staff.
Financial and personnel resources to develop and implement an EMS.	Limited financial or personnel resources to develop and implement an EMS.
Involvement of personnel from all parts of the organization in EMS development.	Few personnel involved in EMS development.
Broad scope in the evaluation of environmental impacts.	Narrow scope in the evaluation of environmental impacts.
Stretch goals for improved environmental protection.	Easily attained goals for improved environmental protection.
Use of communication tools as feedback mechanisms to inform members of requirements, report performance, and implement system adjustments.	Incomplete feedback mechanisms due to poor communication systems.
Technical expertise either in house or from outside consultants.	Limited technical expertise.
Availability of tools (training, templates, and guidelines) to assist in EMS development and implementation.	Few tools to assist in EMS development and implementation.
Involvement of outside stakeholders either from the government, other businesses (industry associations), or the community.	Isolated development and implementation of the EMS.
Determination to break through limits to environmental improvements through technical, economic, or cultural change.	Limits to environmental improvements resulting from technical, economic, or cultural factors.

IX. Conclusions and Recommendations

Objective 1: Determine whether and how the use of an EMS by a regulated entity increases public health and environmental protection over their current regulatory requirements.

Conclusions

1.1. EMSs Can Have a Positive Impact on Environmental Protection

The data collected during the EMS pilot project supports the conclusion that EMSs *can* have a positive effect on environmental protection and increase protection above that provided by a regulated entity's current regulatory requirements. Improvements were observed in each of the three sets of indicators of improved environmental protection measured in the pilot project: awareness and commitment, systems management of environmental impacts, and performance of key environmental indicators. Environmental performance improvements indicate that EMSs can be an effective pollution prevention (P2) tool.

Improvements in environmental protection were measured three ways. First, a pilot may perform greater than legally mandated emission requirements (e.g. permitted air or water emission levels). Second, a pilot may mitigate environmental impacts not covered by law and regulation. Third, a pilot may improve its level of environmental protection above that provided prior to EMS implementation. The first two measures are consistent with AB 1102 (Stats. 1999, Ch. 65) PRC § 71045 et seq., while the last measure is needed to understand whether an EMS in helping change the level of environmental protection at an organization.

Environmental policies demonstrated "Awareness and Commitment" that went beyond simply meeting regulatory requirements. Aspect and impact identification uncovered several areas needing better management that lay outside of the regulatory arena. Objective and targets specifically identified commitments and showed that progress is being made in meeting these commitments. Better systems for environmental protection emerged from EMS implementation including operational controls, training, communication, audits, management review, and corrective action. Pilots were able to achieve significant pollution prevention gains through EMS implementation. For example, environmental performance improvements were seen in non-regulated activities like energy and water conservation, and waste reduction. Gains were also observed in regulated hazardous waste generation.

Pilots performed well in comparison to regulatory requirements. Pilots demonstrated performance exceeding regulatory limits. However, only Artistic set specific objectives to improve performance beyond regulatory limits. The EMS was responsible for improved compliance with regulatory standards at Pentel. IBM demonstrated performance well beyond regulatory limits, but because their EMS evolved over many years it was difficult to attribute performance in regulated areas to their ISO 14001 certified EMS. Most pilot projects improved environmental protection in areas of significant environmental impact that are not addressed by regulation or law.

1.2. A Systems Approach Towards Environmental Management Yields Results

Part of the primary objective of the EMS Pilot Project was to determine how an EMS improves environmental protection. The simple answer is that EMSs help an organization apply sound management systems to environmental issues and integrate environment into the business decision making structure. This is accomplished through taking a 'systems approach' to environmental management that is roughly outlined by the "Plan-Do-Check-Act" cycle. This cycle establishes a system that can affect the culture of an organization and help drive continual improvement in environmental protection.

The ability of an EMS to affect the culture of an organization is critical in producing improved environmental protection. EMS elements like the environmental policy, aspects and impact identification and setting objectives and targets can act to change awareness and commitment of an organization and thus lead to organizational change. Programs and processes that implement the EMS, such as operational controls, training, pollution prevention, audits and management review act to integrate the spirit of the environmental policy into potentially all business functions of the organization. Processes that 'check' the performance of the system and then 'act' to adjust the system provide positive feedback loops that drive continual improvement in environmental protection. Cal/EPA observed organizational change from cultures of compliance maintenance or avoidance to ones of continual improvement and environmental protection beyond regulatory commitments.

For an organization to successfully implement systems based management of the environment, key elements must be present. Based on the information collected in the pilot project, Cal/EPA has identified the following key elements:

- An environmental policy with commitments to pollution prevention, resource conservation, compliance, public involvement and continual improvement;
- Whole system assessment of environmental impacts and identification of those which are most significant;
- Objective setting for the reduction of environmental impacts;
- Measuring and monitoring of practices and performance which support environmental policy and objectives;
- Operational controls;
- Audits (internal and third party);
- Management review and adjustments in the system to ensure continual improvement;
- Involvement of effective stakeholders; and
- Public reporting of performance results.

1.3. EMSs Require a Foundation of Enforceable Standards

While the pilot projects' EMSs demonstrated increased environmental protection, an EMS cannot guarantee environmental protection beyond an organization's regulatory requirements. Further, the presence of an EMS cannot ensure regulatory compliance. The role of an EMS, in the regulatory context, is to help the organization meet its legal requirements. In no way should an EMS be viewed as or considered as a replacement for mandatory and enforceable regulatory standards. On the contrary, well functioning EMSs demonstrate the need for clear operating instructions, audits, corrective action and continual improvement. Laws and regulations provide external operating requirements while regulatory inspections and enforcement provide external audits and mechanisms for corrective action. Further, meeting regulatory compliance requirements often motivates EMS implementation and many EMS elements (environmental policy, education, operational control, audits and corrective action) are directed towards meeting regulatory standards.

Enforceable standards are essential to public health and environmental protection in California because they set the minimum expected level of behavior. Regulatory standards are effective motivators of performance. Regulatory review of an organization's performance is critical to the continued protection of public health and the environment as well as the successful operation of an organization's EMS.

1.4. EMS Can be a Tool for Sustainable Development in California

The central characteristics of an EMS make it a potential tool for enabling sustainable development in California. The ability of EMSs to affect cultural change in an organization and establish a process of continual improvement toward environmental goals can be used to help direct improvements in California's environment, economy and quality of life. By taking a systems approach to environmental management, EMSs have demonstrated that integrated and goal based environmental management achieves results. Economic and social goals can easily be incorporated into the EMS structure. EMSs have already demonstrated economic benefits. Environmental efficiencies translate into economic efficiencies, which translate into investment and job creation. EMSs can help create sustainable businesses. The stakeholder partnerships created or evaluated in the EMS Pilot Project demonstrate the potential effect EMSs can have on communities through establishing and building relationships and a common sense of purpose.

Recommendations

1.1. Government, in consultation with the public, business, and academia, should find ways to use EMSs as a tool for the further and continual improvement of public health and environmental protection.

Now that the potential benefits of EMSs have been demonstrated and an understanding of how improved protection is achieved, the next step is to determine how to best harness EMSs in the service of improved public health and environmental protection. Three actions are recommended to develop EMS as a tool for improving public health and environmental protection.

A. Convene Sustainability Partnerships

Begin by applying a systems approach to environmental management for larger organizations, including industrial sectors or geographic regions, by establishing voluntary partnerships. The goal of these partnerships would be to establish a system of continual improvement in public health and environmental protection within an industrial sector or region. The partnerships would embark on a plan-do-check-act process designed to address significant and persistent environmental problems. These partnerships should also address the other elements of sustainability including economic wellbeing and social equity and strive to establish sustainability as a basis for planning and decision making.

B. Use performance targets and recognition as drivers and incentives for improved environmental protection

EMSs use the objective and target process to drive improvements in environmental performance. Government should explore using this fundamental process of an EMS as a tool for driving environmental performance towards publicly created environmental targets. These targets can either be voluntary or legally mandated. Legally mandated schedules for performance improvements, or targets, have been used successfully in the past and should be used in the future. EMSs may help organizations comply with these targets. Stakeholder partnerships, like the one described in the above paragraph, may also establish voluntary performance targets. The continual improvement nature of an EMS can help move organizations along a path towards meeting performance targets. Individual organizations can align their system of setting and meeting objectives and targets with externally created targets. Incentives for meeting voluntary targets could include recognition of 1) EMS implementation; 2) agreements to work towards targets; and 3) achievement of performance targets.

C. Explore Regulatory Track for High Performing Organizations

Once experience working with EMS in a regulatory context is gained after implementing the above recommendations, an exploration of a more formal regulatory track for the highest environmental performing organizations might be warranted. Many states and nations are establishing such tracks and California can benefit and learn from their experience. The following criteria must be met should a complementary regulatory track be established in California.

a) Compliance with all applicable regulatory standards must be assured. A complementary or alternative regulatory pathway cannot be used as a means to "backslide" on existing standards. Preference should be given to systems that would achieve performance significantly beyond that required by existing law. The determination as to what is "significantly beyond" would be part of the future vetting process. Consideration could be given to different process standards, i.e. how performance is achieved; however, the legally required level of performance should not be compromised.

b) Information accessible in the public domain should not be degraded, but enhanced. As in the recommendation above, preference should be given to systems that lead to higher quality information received by the agencies and the public, and to systems that produce this information more efficiently and effectively.

c) The system should be of significant value to the agencies, the public, and the regulated community. This means that by using simpler, more efficient means to produce better environmental results and information, both sides of the regulatory transaction benefit. Communities must also benefit in the way of improved protection, or quality of life. Without this mutual benefit, an alternative track will fail.

Objective 2: Determine whether and how the use of an EMS by a regulated entity provides the public greater information on the nature and extent of public health and environmental effects than information provided by their current regulatory requirements.

Conclusions

2.1. EMSs Generate New and Useful Information about the Nature and Extent of Public Health and Environmental Impacts

The EMSs evaluated in this pilot project generated new and useful information not required by law or regulation. Environmental policies, aspects and impacts, and objectives and targets were created as a result of EMS implementation. These EMS elements provide new and potentially useful information about the nature of public health and environmental effects of the pilot's activities because they illustrate the pilot's awareness and understanding of risk and their commitment to control, reduce or eliminate risk. Internally, this type of information is important to the operation of the EMS by providing specific direction through policy, increased knowledge of impacts and responsibilities, and indicators to measure performance. Externally, this information can provide the public with greater understanding of the nature of risks and the actions being taken to mitigate those risks. EMS information also, at least qualitatively, provides information on the extent of public health and environmental effects of the organization's operations by identifying impacts that are local, regional, or global.

Significant improvements in environmental communication were observed through the EMS Pilot Project. Pilots willingly shared environmental information with the stakeholder Working Groups, which included members of the public. Information included policies, impacts, objectives and targets, implementation programs and performance data. Pilots invited stakeholders into their facilities and provided EMS overviews and facility tours. Stakeholder groups did influence EMS development at CMSA and the Sonoma County Wineries. One pilot, LM Aero – Palmdale exceeded the Hazardous Materials Business Plan requirements by giving seminars and plant tours to emergency responders. Environmental information was also posted on corporate web sites. Improvements in environmental information, however, were sometimes limited in either the scope of information or access to that information. Pilots willingly shared EMS information with the stakeholder work groups; however, members of the general public did not have the same access. The use of the internet can provide the general public with better access; however, corporate web sites, with the exception of LM Aero – Palmdale, do not provide local facility information.

2.2. Potential for Improved Sharing of Environmental Information with the General Public not yet realized.

Environmental information generated by a pilot's EMS is usually organized in ways that make the information relevant and accessible. However, this information is generally used for internal purposes, or made available to the public only on request. With the exception of the Cal/EPA sponsored stakeholder Working Groups, environmental performance information generated by the pilots was not usually shared with the general public. The Internet and Annual Reports were seen as new ways for communicating environmental and public health information to the public. Although the pilots that used these media for information sharing consolidated information at the corporate level, considerable information is provided including compliance information, EMS policies, and performance data. In order for these avenues to provide more meaningful public information, local data needs to be included as well as data on specific impacts and commitments for lessening those impacts. Involving stakeholders will be critical in developing information systems that provide relevant and accessible information.

Recommendation

2.1. Government can support environmental information sharing with the public and recognize efforts to share information

EMSs provide an excellent structure for gathering information. Government can help make environmental information available to the public, such as information on environmental impacts, targets for improvement, and progress towards goals. Improved information sharing could be one criterion for public recognition of environmental efforts and part of industrial sector or regional EMS approaches.

The type of information generated by EMSs may be valuable to both environmental agencies and communities. Communities or non-governmental organizations could use the information to track environmental issues important to them and provide feedback to both regulatory agencies and to the organization with the EMS. Therefore, EMSs have the potential of establishing performance enhancing communication systems between industry, communities, and government. Stakeholders must be involved in establishing these systems.

Government could explore developing a reporting approach for organizations with EMSs, which meet multiple agency requirements in a consolidated fashion. In this way, government may improve access to relevant environmental performance data, recognize accomplishments, and make reporting requirements more efficient.

Objective 3: Evaluate economic indicators to determine incentives and barriers to EMS implementation.

Conclusions

3.1. Economic Incentives and Barriers are both Present in EMS implementation.

The potentially significant cost savings resulting from EMS implementation can provide an incentive for organizations implementing an EMS. LM Aero – Palmdale saved over $1 million per year between 1992 and 1999. Savings are attributed to reductions in generation of hazardous waste, demand on air and water treatment systems, need for laboratory analysis, fees and taxes. Artistic Planting is saving $116,896 per year due to EMS implementation. These savings primarily result from increased efficiency in the use of resources and materials and allowed Artistic Plating to hire a new waste water treatment operator. In general, economic savings and efficiency can result from EMS implementation. Establishing performance objectives and improving operational control can help increase efficiency and save money. Water, energy, materials and waste all have economic costs associated with them.

EMSs also require economic investment. Although specific costs were not provided, EMS implementation required considerable amount of personnel hours and could include consultant fees. EMSs could also help prioritize spending on new processes and operations. Long pay back periods could act as a barrier to EMS implementation, especially for small companies. The Artistic Plating example, however, indicates that substantial savings can accelerate return on investment.

3.2. Limited economic data on costs and benefits is available from organizations implementing EMS.

Only two pilots provided economic data on the costs and benefits of EMS implementation. Further, the data provided was limited especially when identifying costs of EMS implementation. Greater and more complete economic data can be helpful in motivating other organizations to implement EMSs.

Recommendations

3.1. Economic planning tools should be included in EMS assistance tools including guidelines and templates.

Although many cost savings can result from EMS implementation, they can also be expensive undertakings. Economic planning may help organizations decide whether EMS implementation is economically feasible. Tools that assist organizations in making the business case for EMS implementation should be included in any EMS template or guideline.

3.2. Government can help collect and distribute economic data on EMS implementation.

Government can be a clearing house of economic data on EMS implementation. In order to allay concerns over sharing sensitive economic data, the data could be made available while protecting the identity of the individual organizations. Academia may play an important role in studying the economic costs and benefits of EMS implementation. Further, better tools for measuring these costs and benefits need to be made available to organizations.

Objective 4: Identify challenges and successful examples of EMS implementation.

Conclusions

4.1. Small and Medium Sized Enterprises (SMEs) May be Especially Challenged in Implementing EMSs

The economic and human resource requirements of EMS implementation can be a challenge to any organization; however, this is especially true for SMEs. Smaller organization may also lack the resources to overcome technical challenges of EMS implementation. Government involvement helped Benziger, Davis Bynum, CMSA and Artistic, all SMEs, overcome barriers to EMS implementation.

4.2. Leadership and systems approaches are important for successful EMS implementation

Similar characteristics were observed in pilots with successful EMSs. These characteristics include leadership qualities like strong management commitment and the presence of one or more champions. Another characteristic is the extent to which system approaches are applied to the EMS. This includes integration of the EMS into all elements of organizations activities and the establishment of information feedback loops which drive continual improvement through audits, performance monitoring and corrective action.

Recommendation

4.1. Government Support for EMS Implementation Could Improve Public Health and Environmental Protection and Information Sharing.

As the protector of the public good, government has a special role in supporting EMS development. Government's interest in supporting EMS should be based on a desire to improve environmental protection and information to the public. This report has concluded that EMSs can have a positive effect on environmental protection; therefore, EMSs should be viewed as a viable and potential tool for increasing environmental protection. Below are some of the ways government can support EMS development and improve environmental protection.

- Provide tools such as templates or EMS implementation guides.
- Provide grants for the development of tools for a particular industrial sector.
- Establish partnerships between industry, government and community stakeholders in order to increase the flow of information about environmental impacts and protection.
- Establish goals for regulated and non-regulated environmental impacts. Either voluntary or mandatory, these goals could influence EMS objective setting.
- Recognize companies operating in excess of regulatory standards. Public recognition could be based on the implementation of an EMS, compliance with environmental laws, the sharing of environmental information, and progress

towards government-accepted goals, or achievement of government-accepted goals.

- Provide resources to help organizations break through barriers that may limit environmental improvement.
- Establish standard public reporting guidelines.
- Include increased public reporting in environmental recognition programs.

Environmental Performance Summary Table

Pilot Project	Principal Objectives and Targets			Overall Environmental Accomplishments
	Target	Status	Regulatory Requirements	
Anheuser-Busch Inc.	Reduce energy usage by 10% Reduce water discharges by 10% Improve waste segregation by 15% Maximize use of renewable resources Increase employee awareness	Targets not met during the reporting period. A-B, I has modified tracking system and now employs an index which includes electricity, fuel, water chemical usage, BOD, TSS, solid waste, chemical count and purchased CO2 for annual 1% reduction corporate wide. Status not known.	No requirements	98.3% recycle rate of wastes and by-products Reduced Toxic Release Inventory Ammonia from 12.38 lbs. per barrel in 1996 to 6.71 lbs. per barrel in 1999
Artistic Plating	Eliminate perchloroethylene Reduce nitric acid by 95% Reduce wastewater: • Liquid chrome by 10% • Cyanide by 50% Reduce process water use	Eliminated PERC No reduction. Substitution on trial. Reduced by 50% Reduced by 50% No reduction due to production increase. Variance granted.	Meets new requirement Meets requirements Beyond requirements Beyond requirements Meets requirements	Implemented EMS using US EPA sponsored metal finishing EMS template. Achieved significant environmental performance results. Saving $116,896 per year due to environmental projects.
Central Marin Sanitation Agency	Reduce Plant Process Odor Co-generation emission reduction Complete energy audit	Under Development	Beyond requirements Beyond requirements Beyond requirements	Established objectives and targets. Developing implementation programs.

Environmental Performance Summary Table (continued)

Pilot Project	Principal Objectives and Targets			Overall Environmental Accomplishments
	Target	Status	Regulatory Requirements	
Benziger Family Winery	Reduce energy by 20% Establish water use baseline Generate 5% of electrical power	In process	No requirement	Established objectives and targets. Developing implementation programs.
Davis Bynum Winery	Establish baselines for energy and water use. Reduce energy and water use by 10% in 2003	In process	No requirement	Established objectives and targets. Developing implementation programs.
IBM	Conserve 4% energy use Reduce solid waste Reuse/recycle materials	Reduced 4% per year Reduced by 73% Recycle 80.6%	Beyond requirements Beyond requirements Beyond requirements	Increased efficiencies produced per unit savings. *Waste water discharge* 1994 = 5.6 mill g/mill units 2000 = 2.16 mill g/mill units *Haz. waste generation* 1994 = 46.1 tons/mill units 2000 = 18.6 tons/mill units
LM Aero – Palmdale	Reduce hazardous waste 10% in 2000 Reduce workday rate by 10% in 2000 Achieve Zero Notice of Violations Reduce solid waste disposal and cost by 10% in 2000	9.5% reduction 50% reduction No violations in 1999, 2000, and 2001 Increased by 5%	Beyond requirements No requirements Meets requirements No requirements	91% reduction in hazardous waste (1991 – 2000) 42% reduction in hazardous waste (1996 – 2000) Reduced environmental costs over $1 million per year. From $2,157,000 in 1992 to $1,057,000 in 2000.

Environmental Performance Table (continued)

Pilot Project	Principal Objectives and Targets			Overall Environmental Accomplishments
	Target	Status	Regulatory Requirements	
Pentel	Reduce alcohol use by 100% Reduce usage of hazardous solvent D-309 by 5% Reduce spent wastewater treatment filters disposed by 50% Reduce wastewater treatment sludge by 30% Reduce natural gas usage by 5%	100% reduction 25% reduction 50% reduction 59% reduction 14% reduction	Meets new requirements Beyond requirements Beyond requirements Beyond requirements Beyond requirements	Pentel has also achieved the following performance improvements. • Plastic Scrap – 2.8 to 1.9 million pieces per month • Oily Wastewater – 253 to 82 gallons per month • Absorbent – 250 to 50 pounds per month • Metal Bearing Wastewater – 600 to 159 gallons per month • Waste Ink – 41 to 24 gallons per month
San Diego	Reduce electricity use by 5% in 2000 Reduce potable water use by 5% in 2000 Reduce refuse removal by 5% in 2000 Reduce miscellaneous chemical use by 5% in 2000	5% reduction 6% reduction 19% reduction 13% reduction	Beyond requirements Beyond requirements Beyond requirements Beyond requirements	Environmental audits discovered significant problems with recycling program and non-potable water use. Issues were corrected and resulted in fewer recycling loads being rejected and increase use in non-potable water.

Cal/EPA Environmental Management System Project
Public Report:
Final Report

I. Background

The quest for a sustainable world has a brief but impressive history. It began just over two decades ago with the work of the *United Nations World Commission on Environment and Development*. The Commission's report "Our Common Future", published in 1987, identified worldwide pressures and proposed actions that would foster sustainable development. Then in 1992, 172 nations participated in *The United Nations Conference on Environment and Development* in Rio de Janeiro, Brazil. Significantly, one result of the conference was the adoption of a comprehensive set of guidelines, Agenda 21, for achieving a sustainable global environment. Another result of the conference was the international business community's support for the development of standardized management systems for environmental protection. By 1996, the International Organization for Standardization (ISO) developed the "Standard for Environmental Management Systems", or ISO 14001 as it is most commonly called. From ISO 14001 has emerged an environmental management system (EMS) approach to managing and preventing pollution in regulated and non-regulated enterprises.

In 1998, the California Environmental Protection Agency (Cal/EPA) established an *Innovation Initiative* as a response to the growing international interest in achieving a sustainable global environment. It joined with U.S. EPA, non-government organizations (NGOs), business, academia and other states as a member of the Multi-State Working Group (MSWG) to study the environmental benefits of EMS as a tool for enhancing environmental protection and achieving sustainable development. The MSWG participants and observers presently include all 50 states, several of which are actively engaged in approximately 50 EMS pilot projects.

Because of the significant policy implications of the *Innovation Initiative*, the Legislature authorized the Cal/EPA to establish up to eight pilot projects with which to evaluate the potential of EMS in California. This report describes the findings and recommendations resulting from the *Environmental Management System Project* (EMS Pilot Project) as prescribed in AB 1102 (Stats. 1999, Ch. 65) Public Resources Code (PRC), Section 71045 et seq. which sunset on January 1, 2002.

New Approaches to Environmental Protection are Needed

The job of protecting human health and the environment is never done. What we know about the environment today – even our knowledge of the questions still to be answered – is vastly greater than what we knew only a decade ago. This knowledge provides ever-increasing evidence of the sensitivity of the environment and human health to the impacts of pollution and the inefficient use of resources.

California has one of the most successful "command and control" environmental protection systems in the world.[8] It has served the State well. Progress toward protecting public health and the environment has been dramatic since the passage of the first environmental laws over thirty years ago. Fair, firm, and consistent enforcement of environmental laws is still, and will continue to be, a cornerstone of environmental protection in California.

California has long been a pioneer in taking the initiative to reduce environmental risks posed by air, water, toxic and solid waste pollution. It must now continue this pioneering tradition by building a cross-media perspective into environmental protection programs and motivate industries to use and conserve resources wisely. Otherwise, the ability to sustain let alone improve the quality of life for Californians will be severely limited.

Consider the following stresses on the quality of our environment:

- California's current population of 34.6 million is expected to increase by 70%, to 58.8 million, by 2040.[9]
- Eighty-five percent of the energy used in California is generated from petroleum products, a major source of emissions that contribute to global warming and depletion of oil reserves.[10]
- Vehicle miles traveled will almost double by 2020.[11]
- Since 1986 over 500 chemicals in use in California have been determined to cause cancer or reproductive toxicity.[12]
- The gasoline additive MTBE has been detected in 62 drinking water sources. Several communities have lost their source water as a result.[13]

These facts are but a sample of the pressures we are placing on our quality of life and natural resources. It is clear that there is much more to be done to address these and other environmental and resource management challenges.

Among the options for addressing these challenges is a more holistic approach to managing our businesses and industries – an approach that serves both quality of life and economic values. Many corporations are seeking more cost-effective ways to meet regulatory requirements, and some leading corporations are recognizing environmental protection as part of their mission and image. Non-Government Organizations (NGOs) and local communities want a cleaner and safer environment, and are striving to ensure

[9] State of California, Department of Finance, *County Population Projections with Race/Ethnic Detail*, 2000
[10] California Energy Commission, *California Energy Facts*, August 1998
[11] California Department of Transportation, Transportation System Information Program, *California Motor Vehicle Stock, Travel and Fuel Forecast*, November 1997
[12] State of California, Office of Environmental Health Hazard Assessment, *Chemicals known to the State to Cause Cancer or Reproductive Toxicity*, Internet posting, March 10, 2000
[13] California Department of Health Services, Drinking Water Quality Database, 2000

that environmental information is available to them and that their voices are heard. The EMS approach to environmental protection shows considerable promise as an additional tool for meeting these objectives.

II. Pilot Project Goal

The EMS Pilot Project goal is to understand whether and how EMSs can help improve public health and environmental protection in California.

III. Pilot Project Objectives

The objectives of the EMS Pilot Project as specified by law are to evaluate:

1. Whether and how the use of an environmental management system (EMS) by a regulated entity increases public health and environmental protection over their current regulatory requirements [14] and;
2. Whether and how the use of an EMS by a regulated entity provides the public greater information on the nature and extent of public health and environmental effects than information provided by their current regulatory requirements[15].

To the above, Cal/EPA added the following objectives:

3. Evaluate economic indicators to determine incentives and barriers to EMS implementation.

4. Identify challenges and successful examples of EMS implementation.

Each of the pilot projects may have identified additional project-specific objectives that characterize unique aspects of a pilot's EMS.

IV. What is an EMS?

An environmental management system (EMS) is a voluntary management process designed to help an organization meet environmental objectives and achieve and demonstrate improved environmental performance. An EMS employs a systems

[14] Protection provided by current regulatory requirements is defined as those protections provided through the issuance, enforcement, and monitoring of any permit, requirement, authorization, standard, certification, or other approval issued by a federal, state, regional or local agency to the regulated entity for the protection of the public heath or the environment (PRC § 71046(a)(1)).

[15] Information provided by current regulatory requirements is defined as that information provided through the issuance, enforcement, and monitoring of any permit, requirement, authorization, standard, certification, or other approval issued by a federal, state, regional or local agency to the regulated entity for the protection of the public heath or the environment, or any other law or regulation governing the disclosure of public information (PRC § 71046(a)(2)).

approach[16] to environmental management by providing a comprehensive review of an organization's operations to identify and manage or lessen the environmental impacts of operations, to maintain regulatory compliance, and to identify opportunities and create practices for more efficient use of raw materials and resources. It is a process of continual improvement and, as such, results must be monitored and reported frequently to determine the effectiveness of the process and the need for system adjustments. Understanding the actual practice of EMS implementation and its ability to better protect the environment is the purpose of the Cal/EPA EMS Pilot Project.

There are several models for EMSs. In 1996 the International Organization for Standardization (ISO), a non-governmental international organization based in Geneva, Switzerland, developed the "Standard for Environmental Management Systems", or ISO 14001 as it is most commonly called. In the United States, organizations can elect to be certified (registered) to the ISO 14001 Standard by an independent auditor registered by the American National Standards Institute Registration Accreditation Board (ANSI RAB).

From ISO 14001 has emerged an environmental management system (EMS) approach to managing and preventing pollution in regulated and non-regulated enterprises. It is important to understand that ISO 14001 certification is given to the *process* not the results. Results must be measured and evaluated externally by regulators for compliance and internally by management for other environmental objectives such as resource use efficiencies. The ISO 14001 Standard however, requires that the organization's processes for environmental protection continually improve. Process improvements are assumed to lead to better environmental performance results, such as improved compliance or the conservation of resources. This assumption is tested in the Cal/EPA EMS Pilot Project. The continual improvement nature of an EMS may create a nexus between the EMS process, the regulatory system, and the long-term environmental societal goal of an improving environment.

An EMS provides a systems framework for a process that includes a continuous cycle of planning, implementing, reviewing, and improving the actions an organization takes to meet its business objectives and environmental obligations. The Plan-Do-Check-Act (or Adjust) cycle broadly outlines the systems approach of an EMS. This cycle establishes a feedback loop that may help drive continual improvement in environmental protection. As shown in Figure 1 below, a continual improvement cycle is established through this process.

[16] An accepted definition of a system is "a set of elements in dynamic interaction, organized for a common goal." Through the implementation of an EMS, an organization operates a system with the goal of improved environmental protection.

[19] Evaluation and Monitoring Parameters are available at www.calepa.ca.gov/EMS.

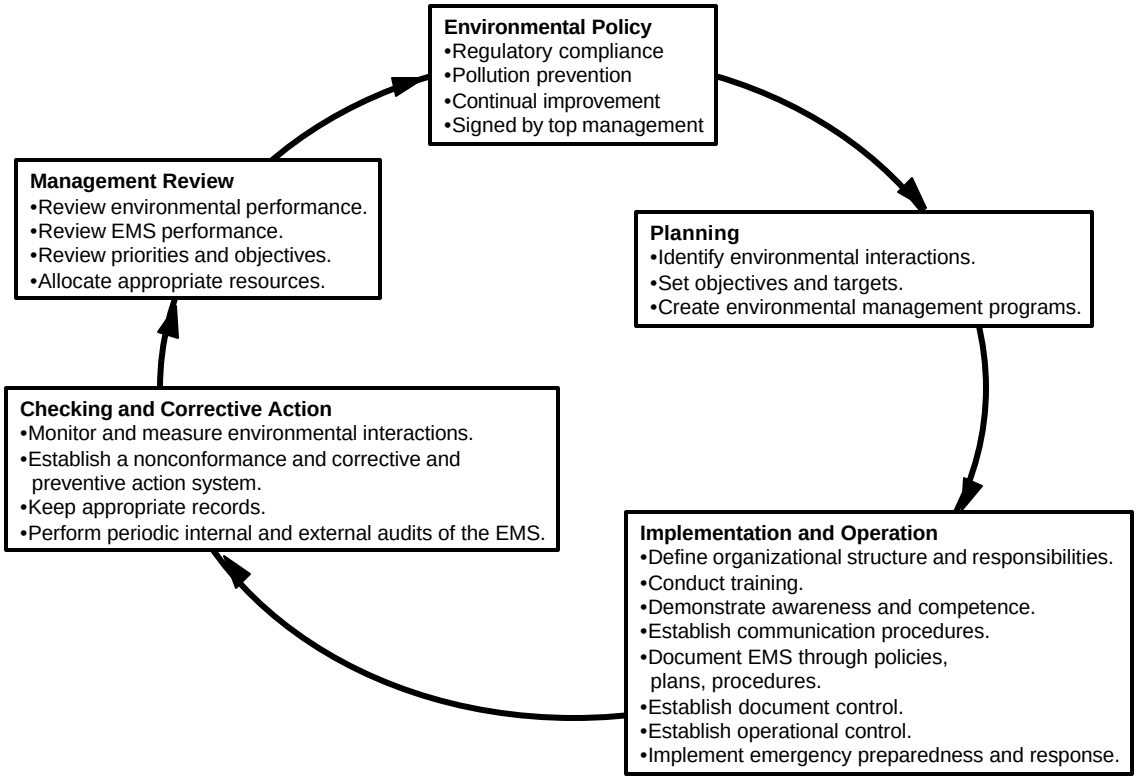

Figure 1: EMS Continual Improvement Process

V. Project Design and Methodology

This section describes the requirements and elements of project design as well as methodology for implementing pilot projects, collecting data, analyzing data and establishing conclusions.

A multi-disciplinary team, administered through the Office of the Secretary, managed the EMS Pilot Project. Team members, from the Air Resources Board, Department of Toxic Substances Control, Integrated Waste Management Board, and State Water Resources Control Board, served as project managers for the pilot projects.

Phase I –Pilot Project Development

Phase I of the project consisted of identifying and soliciting stakeholders, including business, government, academia, and non-governmental organizations, to participate in workshops to design the Project, the criteria by which pilots would be selected, data collection protocols, and Pilot Project Work Plans. This was accomplished with the help of two stakeholder Working Groups. This phase concluded with two public hearings in May 2000 and the selection of seven pilot projects.

Selection of pilot projects was based on the following selection criteria:

- Pilot projects will have an ongoing or planned EMS that can reasonably be expected to produce greater environmental protection than would otherwise be achieved by the existing regulatory process.
- Pilot projects will engage in a multi-media environmental approach (e.g., air, water, solid and hazardous waste).
- Pilot projects will pursue appropriate pollution and waste prevention opportunities.
- Pilot projects will share information learned from EMS implementation with Cal/EPA, regional and/or local working groups, and the public. Pilot projects agree to provide specific data on the goals, implementation, and performance of their EMS as reported in the national and California supplemental data protocols.
- Pilot projects will participate on the Northern or Southern California EMS Working Group.
- Pilot projects will declare to Cal/EPA any current and past (three years) violations cited by environmental regulatory agencies.
- Pilot projects will address known regulatory deficiencies, as required by the appropriate regulatory agency, through their EMS.
- Pilot projects' top management will make a full commitment to participate in the project through a letter of intent.
- Pilot project will represent diversity in terms of location/geography, size, industry type or sector, environmental impacts, and the range of EMS maturity.

Meetings with stakeholders began in 1998, prior to the present pilot project, and sought to define how best to involve interested individuals, communities, organizations, academics, business and government. Based on stakeholder recommendations, two Working Groups, one in Northern California and one in Southern California were established in 1999. Also, Local Working Groups for individual pilot projects were encouraged. Several workshops were conducted to involve stakeholders directly in the development of pilot project selection criteria, pilot project work plans, and evaluation and monitoring parameters (data collection protocols).

Cal/EPA also consulted with the boards, departments and offices within Cal/EPA, other interested state, regional and local agencies and other interested parties. Consultation with these entities took place through briefings to executive staff, regular and electronic mailings of public notices and draft documents, and inclusion of state, and regional and local agencies within the stakeholder working groups. Prior to selecting the pilot projects, state, regional and local environmental enforcement agencies were contacted to determine compliance history of the project candidates.

In addition to the stakeholder workshops, Cal/EPA conducted two publicly noticed hearings in May 2000, one in Southern California and one in Northern California.

After completion of the public involvement process, Cal/EPA selected the following seven pilot projects in June 2000.

- Anheuser-Busch, Incorporated, Fairfield (A-BI)
- Two publicly owned wastewater treatment facilities: Central Marin Sanitation Agency in San Rafael (CMSA); San Diego Metropolitan Wastewater Department, Operations and Maintenance Division, San Diego (San Diego)
- IBM Corporation, San Jose (IBM)
- Lockheed Martin Aeronautics Company, Palmdale (LM Aero – Palmdale)
- Two metal finishing facilities: Artistic Plating, Anaheim (Artistic); Gene's Plating, Los Angeles (later removed from the project)
- Pentel of America, Ltd., Torrance (Pentel)
- Two Sonoma County wineries: Davis Bynum Winery; Benziger Family Winery (Wineries)

Following the public hearings, Cal/EPA established Evaluation and Monitoring Parameters and a Model Pilot Project Work Plan. Each pilot project completed a Work Plan based on the model. The Pilot Project Work Plans set project objectives and roles and responsibilities for each pilot organization and Cal/EPA. Evaluation and Monitoring Parameters were the basis for data collection and will be discussed in the next section.

Phase II – Data Collection, EMS Education

The second phase of the pilot project involved collecting data from pilot projects on pre-EMS conditions and EMS implementation using the Evaluation and Monitoring Parameters as well as facility visits.

Evaluation and Monitoring Parameters selected for the EMS Project consist of the National Database on Environmental Management Systems Data Protocols (National Database) administered by the University of North Carolina and the Supplemental California Protocols. The National Database was developed by the Multi-State Working Group on EMS and funded by the US EPA. The Database is used to collect standardized information on EMSs from pilot projects all over the United States. The National Database Protocols can be downloaded from the Environmental Law Institute web site (http://www.eli.org/isopilots.htm). Because of the specific information requirements of AB 1102 (Stats. 1999, Ch. 65), PRC § 71045 et. seq., Cal/EPA created supplemental data protocols to be used only in the California pilot projects. The California Protocols are included in Appendix K. Each of these Evaluation and Monitoring Parameters is described in more detail below.

The National Database is the primary data set for the Cal/EPA EMS Pilot Project. Information was collected using three protocols: baseline, design and update. Baseline environmental conditions were established through the use of the National Data Baseline Protocols. These protocols required three years of pre-EMS environmental performance data as well as information on pre-EMS conditions in the following areas.

- Management Systems
- Environmental Conditions
- Environmental Performance
- Compliance
- Pollution Prevention
- Interested Party Involvement
- Economic Performance.

Information on the design of the pilots' EMS was collected using the National Database Design Protocol and provided the following information:

- Rationale for adopting an EMS
- Corporate-Facility EMS Relationships
- Process for developing Environmental Policy
- Environmental Aspects and Impacts
- Objectives and Targets
- Supply Chain Relationships
- EMS Structure and Responsibility
- Training
- Monitoring and Measurement of Regulatory Compliance
- EMS Audits
- Management Review
- ISO 14001 Certification
- Cost of EMS Design

In order to measure the effect of EMS implementation on the pilot projects' environmental performance and management, up to two years of post-EMS data were collected using the National Database Update Protocols. The update protocols revisit each of the data categories collected in the baseline and design protocols.

The supplemental California Protocols were created to address specific data needs of the Cal/EPA EMS Project not addressed by the National Database. A primary purpose

of the California Protocols was to answer whether and how an EMS provides greater environmental information to the public than that provided by the current regulatory system. The California Protocols also sought information on whether and how pilot EMSs met or exceeded environmental regulatory requirements. Each pilot project was asked specific questions in the following areas:

- Emergency Preparedness
- Environmental Performance
- Pollution Prevention
- Continual Improvement
- Employee Involvement
- Regulatory Innovation
- Supply Chain
- Quantity of Information
- Negative Consequences of an EMS

Because the understanding of the EMS technology varied amongst pilot projects, stakeholders, and Cal/EPA, establishing a basic understanding of EMS was another objective of this phase. This objective was accomplished through a series of four educational workshops given both in Southern and Northern California and funded by a US EPA grant. Workshop agendas included hands-on exercises and discussions on the design and implementation of an EMS, auditing, and public policy issues.

Data collection and EMS education were also accomplished through stakeholder site visits at each of the pilot project facilities. These on-site Working Group meetings facilitated dialogue between pilot project participants, Cal/EPA and stakeholders regarding pilot facility EMS design and implementation. During these meetings, pilot organizations shared information on EMS implementation, led a facility tour, answered questions, and received feedback from stakeholders on their EMS design and implementation. The following table shows the schedule for pilot facility visits.

Table 1
Site Visit Schedule

September 2000	Artistic Plating and IBM
November 2000	Benziger Family Winery
January 2001	Lockheed Martin Aero – Palmdale
March 2001	Central Marin Sanitation Agency
April 2001	Davis Bynum Winery
April 2001	San Diego Metropolitan Wastewater Department Operating and Maintenance Division
May 2001	Pentel of America, Limited
May 2001	Anheuser-Busch, Inc.

Phase III – Data Analysis and Methodology

The final phase of the EMS Project involved analysis of the data, development of findings and conclusions for each of the pilots, and establishing the overall conclusions of the project. Each pilot project is described in Appendices A through H. Data analysis is conducted based on methodology described below and supports determinations as to whether and how the use of an EMS:

- By a regulated entity increases public health and environmental protection over the current regulatory requirements and;
- Provides the public greater information on the nature and extent of public health and environmental effects than information provided current regulatory requirements.

The above two statements closely paraphrase AB 1102 (Stats. 1999, Ch. 65) PRC § 71045 et seq. This report and the pilot study reports use the term environmental protection to mean both environmental and public health protection.

This section also describes methodology that supports the formation of findings and conclusions related to economic impacts of EMS implementation, challenges and successes in EMS implementation, and any specific objectives identified in the individual Pilot Project Work Plans.

Establishing Baseline Environmental Protection and Environmental Information

A baseline establishes conditions from which comparisons can be made. Two separate baseline measures are used in the EMS Pilot Study. The first relates to the pilot organization's regulatory requirements for environmental protection and public information sharing, while the second relates to the environmental performance and information sharing of the pilot prior to EMS implementation.

Establishing a baseline for regulatory requirements is necessary to determine whether a pilot operates beyond the regulatory minimum. Performance beyond the regulatory minimum can be considered two ways. A pilot's performance may be better that what is required, as in discharge limits, or a pilot may extend environmental protection to unregulated areas. Several baselines are established in the pilot projects. The pilot's EMS impact analysis is used to identify both the regulated and non-regulated impacts of a pilot's activities. These are shown in Table 1 of the Pilot Study Reports. This table establishes the extent of impact protection offered by their current regulatory requirements. Commitments of an organization to lessen its environmental impact are shown in Table 2, Objectives and Targets of each Pilot Study Report. This table shows whether an objective meets or exceeds regulatory mandated performance or whether the objective is outside the regulatory arena and therefore if the commitment exceeds regulatory responsibility. Table 4 of the Pilot Study Reports compares a pilot's environmental performance to regulatory requirements. This table offers a direct

comparison between air and water emission limits to actual performance. The table also identifies any objectives and targets that might relate to the discharge limit.

The level of environmental protection that a pilot provided prior to EMS implementation is the second baseline condition measured in the pilot project. Pre-EMS baseline environmental performance data is shown on Table 3 in the Pilot Project Reports along with up to two years of post-EMS update data.

Given the types of baselines described above, improvements in environmental protection could be measured three ways. First, a pilot may perform beyond legally mandated requirements (as in discharge requirements). Second, a pilot may mitigate environmental impacts not covered by law and regulation. Third, a pilot may improve their level environmental protection above that provided prior to EMS implementation. The first two measures are consistent with AB 1102 (Stats. 1999, Ch. 65) PRC § 71045 et seq., while the last measure is needed to understand whether an EMS in helping change the level of environmental protection at an organization.

Legal requirements for making environmental information available to the public are the information baseline for the pilot project. Table 6 in the Pilot Project Reports shows what environmental information is provided by the pilot and whether that information is a legal requirement. If information on pre-EMS environmental information sharing by the pilot is available it is discussed in the text of the Pilot Project Reports.

Methods for Determining Increased Environmental Protection

To determine whether and how improved environmental protection resulted from EMS implementation, Cal/EPA evaluated three primary categories of information from each pilot project:

1. Awareness and Commitment
2. Systems Management of Environmental Impacts
3. Performance for Key Environmental Indicators.

While each of the above categories may indicate improvements in environmental protection, they each provide different types of information, and when taken as a whole, support the conclusions made in this report and in the pilot project reports.

Categories one and two are qualitative measures and may be considered leading indicators of environmental protection in that they measure changes in attitude and behavior and not the protection resulting from those changes. Further, information collected in these first two categories helps explain how an EMS improves environmental protection.

Category three, performance of key environmental indicators, more directly and quantitatively measures actual results and changes in environmental protection. Examples of *key environmental indicators* are energy use, waste generation, and

pollutant emissions. However, even these indicators often do not measure the resulting ecosystem effects such as reduced health risks, more fish in the stream, or less smog.

Ecosystem effects were outside the scope of indicators in the pilot project's EMS and are therefore not included in this study. The three indicator categories of environmental protection relate to each other like building blocks, each level becoming more refined, providing more quantitative information and together presenting a picture of the level of environmental protection provided by an EMS

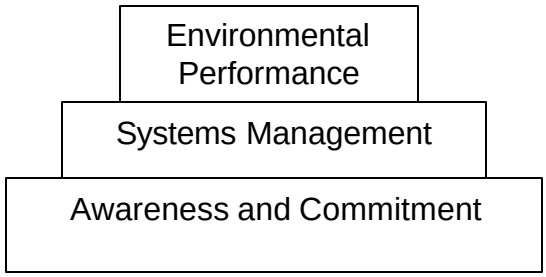

Figure 2: Building Blocks of Environmental Protection Indicator Categories

Awareness and Commitment refers to the scope of environmental issues to which the organization devotes its attention, identifies increased knowledge and understanding of environmental impacts, and recognition that action is necessary to lessen impacts and improve environmental protection. *Awareness and Commitment* is more a predictive and leading indicator of improved environmental protection than an actual measure. For example, an organization may become aware of an impact and commit to reducing its effect; however, the commitment has not yet been acted upon. Even so, measuring and understanding changes in *Awareness and Commitment* as a result of EMS implementation will help determine whether, and especially how, an EMS can improve environmental protection. The following are measures of *Awareness and Commitment* and were analyzed for each pilot project:

- An environmental policy describing the organization's commitments and principles in regards to environmental protection.
- Demonstrated knowledge and understanding of environmental laws, regulations, and other requirements applying to their organization.
- Demonstrated knowledge and understanding of the environmental impacts (regulated and non-regulated) of the organization through the identification of aspects and impacts.
- Documentation of objectives and targets for environmental performance improvements and lessening negative environmental impacts.

The environmental policy of each pilot organization is presented and discussed in each pilot study. The evaluation of whether and how each pilot demonstrates knowledge of

environmental requirements is based on Cal/EPA project manager's experience and knowledge of the pilot's EMS and data collected in the National Database. Knowledge and understanding of impacts is determined by analyzing significant aspects and impacts that are presented in Table 1 of the pilot project reports. This information will help determine whether a pilot's awareness of environmental impacts transcends the scope of impacts that are legally regulated. Objectives and targets indicate environmental commitments. Table 2 of the pilot project reports presents each pilot's objectives and targets, their status, and whether the target exceeds regulatory requirements. By evaluating an objective's status, we can determine what, if any, actions have been taken to meet that objective. Comparing the objective and target to regulatory requirements can identify commitments and/or achievements above and beyond regulatory requirements. This latter element of objective and target research begins to address the environmental performance of the pilot projects.

Systems Management of Environmental Impacts refers to the ability of an organization to better protect the environment through a more mature and effective system of environmental management. Each pilot study report describes the important elements of the pilot project's EMS that provides greater environmental protection through implemented programs and procedures. By looking at the systems for environmental management we can begin to understand not only 'whether' but also 'how' EMSs can provide greater environmental protection.

There are two key measures of a mature and effective system for public health and environmental protection. These are:

- Documented and implemented programs designed to meet regulatory requirements and achieve objectives and targets for environmental improvement; and
- Measures and review processes to assess both the management system and environmental performance and to make adjustments in order to continually improve both.

The programs designed to meet regulatory requirements and achieve objectives and targets are the core implementation elements and the 'do' portion of an EMS. These include operational control or communication programs that focus on impacts such as recycling, water conservation, chemical management, pollution prevention, or purchasing. The programs may also have a broader focus like training, emergency preparedness, compliance assurance or health and safety.

The second measures of *Systems Management* are the 'check and act' processes in the EMS. These processes allow the organization to measure the effectiveness of their programs through the use of system audits and the measurement of performance data. A complete system will include the management review of audit findings and performance measures and result in adjustments and corrective actions thus ensuring the continual improvement of systems that provide environmental protection. Effective communication systems are critical for managing change and directing the organization towards environmental goals and improved environmental protection.

Each pilot study analyzed *Systems Management* by evaluating data collected in the National Database and California Protocols (Evaluation and Monitoring Parameters)[19]. Information shared at the on-site Working Group meetings and other observations by the Cal/EPA project manager contributed to this evaluation. This information supports conclusions as to whether the EMS implementation at the pilot facility has improved environmental protection over pre-EMS conditions and whether that protection meets or exceeds regulatory and legal requirements.

Key Environmental Indicators are the most quantitative and direct way to measure changes in environmental protection. *Key Environmental Indicators* are the direct measures of performance of an EMS. Examples include energy use, water use, solid and hazardous waste reduction, air emissions, and quality of water discharge.

The National Database includes three years of baseline, or pre-EMS performance data and up to two years of update, or post-EMS performance data. This data was used to identify changes in environmental performance that may be attributed to EMS implementation.

Table 3 in the pilot study reports presents both baseline (pre-EMS) and update (post-EMS) performance data for indicators specific and unique to each pilot project. Analyzing this data can indicate whether any improvements in environmental performance occurred after EMS implementation. Table 4 compares regulatory emission requirements with the actual emissions of the pilot. Again, pre and post EMS performance data is presented. This information can be used to determine whether performance (emissions) out performed regulatory requirements and whether performance improved after EMS implementation. Compliance data, including the frequency and type of violations, is another important indicator of environmental protection. Table 5 presents compliance history of the pilot before and after EMS implementation.

Methods for Determining Greater Environmental Information

The provision of greater environmental information can be measured by evaluating the type, relevance, and accessibility of the information. Two indicators are germane to this determination:

- Public access to information about the EMS, environmental impacts and environmental performance.
- Public and stakeholder involvement in EMS development, implementation and review.

Data on the first indicator was collected using the Supplemental California Protocol. Table 6 of each pilot study reports the information topic, whether the information must legally be reported, and the location of the information. Legal reporting requirements establish the baseline, or minimum requirements for information sharing. Information

sharing beyond legal requirements can indicate improvements in communication with the public. Improved compliance with legal requirements as a result of EMS implementation can also constitute an improvement in public information. The location of information indicates the availability of the information. Web site posting, for example, indicates wide distribution of information, while the public relations department or environmental agency may indicate that information is available only upon request.

The level of public and stakeholder involvement in the EMS development, implementation and review not only indicates greater communication, it also indicates a greater participatory role for stakeholders in improving environmental protection. Involvement provides avenues for stakeholder response to environmental information and feedback to the organization on their performance. This indicator of greater environmental information is measured by evaluating actual stakeholder participation in the pilot's EMS and processes in the EMS for outside communication. This information was collected through the National Database, the Supplemental California Protocol and through Cal/EPA project managers' observations.

Methods for Determining Economic Impacts of EMS Implementation

In order to determine what economic impacts (costs/benefits) are associated with EMS implementation, data collected through the National Database was analyzed. Pre and post EMS costs are compared to establish cost savings or cost increases. Economic indicators can help answer how an EMS might improve environmental protection by identifying economic costs and benefits of EMS implementation that might act as barriers or incentives to greater protection.

For some pilots however, little or no economic data is reported in the National Database. Some pilots directly reported economic information to Cal/EPA. This information is primarily anecdotal and may only indicate trends or impressions of the pilot. Still other pilots have no economic information. For these pilots, the question of economic costs and benefits cannot be addressed.

Methods for Identifying Challenges and Successes of EMS Implementation

Lessons learned from the pilots' EMS experiences, challenges and successes were identified through Cal/EPA's Project Manager observations, interviews with personnel and data analysis. Understanding these challenges and successes help answer how an EMS might improve environmental protection.

Methods for Meeting Specific Project Objectives

Individual pilot projects may have project specific research objectives. These are identified in the pilot study reports along with specific methodologies to meet these objectives.

VI. Project Description Summaries

This section briefly describes the background, number of employees and the location of each pilot project. Complete pilot project reports for each pilot can be found in Appendices A-H. The following table summarizes the development and ISO 14001 certification status of each pilot project.

Table 2
ISO Status of Pilot Projects

Pilot Project	Development	ISO 14001 Certification Status
Anheuser-Busch, Incorporated	Fully Implemented and Mature	Certified 1999
Artistic Plating	Recently Implemented	Not Certified
Central Marin Sanitation Agency	Early Design and Implementation	Not Certified
San Diego MWWD,	Recently Implemented	Certified 1999
IBM	Fully Implemented and Mature	Certified 1997
LM Aero – Palmdale	Fully Implemented and Mature	Self Declared Compliant 1998
Pentel of America	Recently Implemented	Certified 2001
Davis Bynum	Early Design and Implementation	Not Certified
Benziger Family Winery	Early Design and Implementation	Not Certified

Anheuser-Busch, Incorporated

Anheuser-Busch, Incorporated (A-BI) is a brewer of malt beverages. A-BI and its parent company, Anheuser-Busch Companies employ more than 24,000 employees in the United States and overseas and are headquartered in St. Louis, Missouri. Operations at A-BI's Fairfield, California facility include brewing, packaging, and distributing beer. The Fairfield facility has approximately 500 employees.

The Fairfield facility began development and implementation of its EMS as part of A-BI's company-wide initiative in 1992. Since 1992, A-BI progressively enhanced its EMS through a continual improvement process. The Fairfield facility was certified to ISO 14001 in December 1999. Further, the company's historical efforts to align its corporate Environmental Health & Safety (EHS) program with the ISO 14001 Standard provided an opportunity to assess the challenges of bridging from an EHS program to a certified EMS. Because of the long history and evolution of environmental management at A-BI, their EMS is considered fully implemented and mature.

Metal Finishing Facilities

Artistic Plating Company

Artistic Plating Company (Artistic), located in Anaheim, California, is a medium-sized metal finishing facility employing 129 individuals. The facility performs copper, nickel, brass, and chrome electroplating and specializes in electroplating zinc die-cast parts and aluminum wheels for commercial customers.

In June 1999, Artistic Plating Company volunteered to test the EMS template developed by U.S. EPA as part of the Merit Partnership Metal Finishing EMS (MFEMS) Template project. The MFEMS Template is based on ISO 14001, covering the elements of an EMS. The MFEMS Template does not include a section on operational controls, however. It is user friendly with tools to assist in implementing the different EMS elements and is tailored to the metal finishing industry. For example, it contains a tool designed specifically for a metal finishing facility to identify its environmental aspects. The template is designed to help a company create an EMS that could serve as an initial step towards ISO 14001 certification. Because systems and comprehensive environmental management is new to Artistic, their EMS is considered recently implemented.

Gene's Plating (Removed From Cal/EPA EMS Pilot Project)

Gene's Plating is a metal finishing facility in Los Angeles, California. The facility performs copper, nickel, and chrome electroplating and various polishing operations. Cal/EPA selected Gene's Plating as a member of its metal finishing project after holding public hearings in May 2000.

At the end of November 2000, the Cal/EPA EMS Project Director learned about an enforcement referral to the Los Angeles City Attorney's office from the Department of Toxic Substances Control (DTSC). According to the referral letter, Gene's Plating was the subject of a joint investigation by DTSC and the Los Angeles County Fire Department in May 2000. Violations cited included possible illegal disposal of hazardous waste to the street, not minimizing the potential for a release of hazardous waste, which could threaten human health or the environment, and hazardous waste container/labeling mismanagement.

Based on the serious nature of the enforcement action and the lack of EMS implementation, Gene's Plating was removed from the Cal/EPA EMS Project. Gene's Plating was notified of their removal from the project by letter dated November 30, 2000.

Waste Water Treatment Facilities

Central Marin Sanitation Agency

The Central Marin Sanitation Agency (CMSA) is a public agency in Northern California that operates a regional wastewater treatment facility. CMSA treats sewage collected from San Rafael Sanitation District, Sanitary Districts No. 1 and No. 2 of Marin County, and San Quentin State Prison. CMSA is a medium-sized wastewater treatment facility

with an average dry weather flow of 10 million gallons per day (MGD) and a 90-MGD peak wet weather flow. The facility is capable of handling up to 125 MGD. The facility currently employs 40 individuals to perform the daily maintenance, operation, and administrative tasks of the wastewater treatment facility.

CMSA agreed to implement an Environmental Management System (EMS) in an effort to improve the management of both the wastewater plant environmental aspects, as well as, the environmental aspects of the dischargers contributing to their flow, such as auto maintenance facilities. CMSA's operations primarily impact water-related media, however, air and land aspects are also affected, as well as other regulated and non-regulated issues. The EMS is being implemented to address all of these in a multi-media approach. CMSA's ultimate goal is to achieve ISO 14001 certification for their treatment plant as well.

CMSA is implementing an EMS program within the public-sector, wastewater treatment industry. CMSA is still in the early stages of EMS implementation and achieving their ISO 14001 Certification. Significant challenges encountered during the beginning of the EMS pilot project hindered some aspects of their progress, yet the desire to earn ISO 14001 Certification is still the objective. For the purposes of Cal/EPA research, CMSA's EMS is considered in the early design and implementation stage.

City of San Diego Metropolitan Wastewater Department, Operation and Maintenance Division

The City of San Diego Metropolitan Wastewater Department, a public agency, manages the resources to operate the Metropolitan sewerage system, which treats the wastewater generated by 15 area cities and districts. They serve 2 million customers generating approximately 200 million gallons of wastewater daily.

The O&M Division within the Metropolitan Wastewater Department operates and maintains several wastewater collection and treatment facilities, manages an operating budget of $70 million, and employs over 300 people. While the facilities are to some degree managed as well as regulated as separate entities, they are interconnected in that performance at one typically impacts performance at another.

The pilot project is classified as a recently implemented EMS for purposes of addressing the research questions. The O&M Division implemented an ISO 14001 EMS, certified in May of 1999 with scope expansions in October 2000 and February 2001. They achieved the distinction of becoming the first publicly owned treatment works in the U.S. to certify to the ISO 14001 EMS Standard.

International Business Machines

International Business Machines (IBM) creates, develops and manufactures advanced information technologies, including computer systems, software, networking systems, storage devices, and microelectronics. The company employs close to 290,000 people in over 140 nations. The pilot project participant is the San Jose Storage Technology Division site, which employs approximately 8,000 workers who develop, manufacture,

and market storage components and systems. Manufactured products include thin film magnetic recording heads, thin film storage disks, and disk drive systems.

In 1992, the San Jose facility became certified to ISO 9001 (an international standard for product quality). In June 1997, as part of IBM's program to register all of its manufacturing and development sites worldwide, the San Jose Storage Technology Division site became the first IBM facility in the U.S. registered to ISO 14001. Because of its long history of environmental management programs, beginning with pollution prevention in the 1970's and its early certification to the ISO 14001 standard, IBM's EMS is considered fully implemented and mature.

Lockheed Martin Aeronautics Company - Palmdale

Lockheed Martin Aeronautics Company – Palmdale (LM Aero – Palmdale) is a leader in the design, development, systems integration, production, and support of advanced military aircraft. Rapid prototyping, simulation-based virtual design, and composite process development are just a few of the many engineering proficiencies that make this company preeminent in the aeronautics industry. The company's headquarters, which is also a major manufacturing operation, is located in Fort Worth, Texas with other major design and manufacturing sites in Marietta, Georgia, and Palmdale, California.

Lockheed Martin Aeronautics Company's site in Palmdale, California, is headquarters to the company's Advanced Development Programs (ADP), informally known as the "Skunk Works." It is also home to the U-2 high-altitude reconnaissance aircraft, upgrades and enhancements to the F-117 Nighthawk stealth attack aircraft, and C-130 special missions aircraft. It is located 80 miles north of Los Angeles in the Antelope Valley.

LM Aero – Palmdale marks 1992 as the beginning of their EMS; however, it was not until 1998 that it self-declared it was compliant with the ISO 14001 EMS Standard. The EMS at LM Aero – Palmdale is considered fully implemented and mature. Certification to the ISO 14001 Standard may be pursued at some later date.

Pentel of America, Ltd.

Pentel of America is headquartered in Torrance, California. While there are offices in several states and a separate blister packaging facility in Torrance, all U.S. manufacturing is carried out at the Torrance factory. Operations include precision metal machining, plastic injection molding, water-base ink production, and writing instrument assembly and packaging. There are approximately 200 employees at the Torrance factory.

As a leading international manufacturer of writing instruments, stationary goods, and art supplies, Pentel Company, Ltd. has facilities located worldwide. Headquartered in Tokyo, Japan, the company employs a total international workforce of 2,100 employees. Products manufactured include automatic (mechanical) pencils, non-refillable roller ball pens, refillable ballpoint pens, gel ink pens, ink, lead, erasers, correction fluid,

highlighters, markers, crayons, water and oil paints, pastels, glue, and artist brushes. Pentel invented roller ball technology and pioneered graphite lead. In addition, Pentel is the only writing instrument company to receive the Deming Award for recognition of the highest standard of quality.

The pilot project is classified as a recently implemented EMS for purposes of addressing the research questions. Pentel began EMS development in October 1999, initiated the first cycle of its EMS in April 2001, and was certified to the ISO 14001 Standard at the end of August 2001. Pentel contributes the perspective and experience of working with a medium-sized manufacturing facility, which has integrated, to the degree possible, an ISO 14001 EMS with the previously existing ISO 9001 registered quality system.

Winery Project: Benziger Family Winery and Davis Bynum Winery

The EMS Winery Pilot Project involves two wineries in Sonoma County, Benziger Family Winery and Davis Bynum Winery. Both the grape growing and wine making operations are included in the pilot project.

The Benziger Family Winery is located on the east side of Sonoma Mountain above the village of Glen Ellen, and is bordered by Jack London State Park to the west. The Benziger Family has operated their winery and vineyards at this location since purchasing the 85-acre Sonoma Mountain Ranch in 1980. Sixty-five acres of vines are planted at the ranch. Another twenty-acre parcel is planted with vines in nearby Sonoma Valley. The Benziger family farms their vineyards using a method called biodynamic farming and were certified in 2000 by the Demeter Association, the international organization that monitors and approves biodynamic practices. Biodynamic farming is similar to organic farming in that it prohibits the use of synthetic fertilizers and pesticides. Grapes are also purchased from more than 60 growers. The Benziger Family Winery produces 180,000 cases of ultra-premium wine per year. The winery employs 49 people full time and 29 people are either part time or seasonal workers.

Davis Bynum Winery was founded in 1973 as the first winery on Westside Road in the Russian River Valley. The vineyards include 22 planted acres of California Certified Organic Farming (CCOF) vines. Davis Bynum is a family operated winery that annually crushes 250-275 tons of grapes to make approximately 15,000 cases of ultra-premium wine. The winery and vineyard is primarily operated by three members of the Bynum family and a head winemaker. Davis Bynum also purchases grapes from neighboring growers. Nine people are employed full time at the winery while three are regular part time employees.

Although there is significant range in size between these two wineries they are both considered medium sized, based on industry standards. Small wineries produce less than 5,000 cases of wine per year. More than half the wineries in California are small wineries. Twenty-five wineries in California are considered commercial wineries, each producing over 500,000 cases per year.

Benziger and Davis Bynum wineries are still in the design and implementation phase of their EMSs. They have cooperatively developed their EMSs with the assistance of Cal/EPA. Work on their EMSs began in April 2000 and as of the date of this report they had developed environmental policies, significant aspects and set objectives and targets. They are still in the process of developing some implementation programs; however, they have begun making progress towards some objectives and targets.

VII. Analysis

This analysis section will address the primary objectives of the Cal/EPA EMS Pilot Project. These are:

> Objectives 1: Determine whether and how the use of an environmental management system (EMS) by a regulated entity increases public health and environmental protection over their current regulatory requirements.
>
> Objective 2: Determine whether and how the use of an EMS by a regulated entity provides the public greater information on the nature and extent of public health and environmental effects than information provided by their current regulatory requirements.
>
> Objective 3: Evaluate economic indicators to determine incentives and barriers to EMS implementation.
>
> Objective 4: Identify challenges and successful examples of EMS implementation.

The experience and understanding of EMSs gained through the pilot projects is used to meet the above pilot project objectives. Examples are taken from the Pilot Project Reports (Appendices A through H) are presented in this section. Readers interested in a more complete analysis and understanding of the findings and conclusions of the individual EMS Pilot Projects are directed to the Pilot Project Reports included in the appendices of this report. The first two objectives are analyzed first by addressing the question of *whether* and then the question of *how*.

Objective 1: Determine whether and how the use of an EMS by a regulated entity increases public health and environmental protection over their current regulatory requirements

This section will address the question of whether and how the use of an environmental management system by a regulated entity increases public health and environmental protection over their current regulatory requirements. Increased environmental protection as a result of EMS implementation can be identified three ways. First, a pilot may perform greater than legally mandated requirements (as in discharge requirements). Second, a pilot may mitigate environmental impacts not covered by law and regulation. Third, a pilot may improve their level of environmental protection above

that provided prior to EMS implementation. The first two measures are consistent with AB 1102 (Stats. 1999, Ch. 65) PRC § 71045 et seq., while the last measure is needed to understand whether an EMS has helped change the level of environmental protection at an organization**.**

The Cal/EPA EMS pilot project measured environmental protection by evaluating three indicators: awareness and commitment; systems for environmental protection; and environmental performance. As described in the Methodology Section of this report, each indicator provides a different measure of environmental protection, with awareness and commitment and systems management of environmental impacts being leading, or predictive indicators of improved protection, while environmental performance is a more direct indicator. Determining 'how' an EMS can improve environmental protection is accomplished by analyzing the processes of organizational change at the pilots. Changes in awareness and commitment and systems management provide the information needed for that analysis.

Awareness and Commitment

Awareness and commitment are indicators of environmental protection because they describe a pilot's knowledge and understanding of environmental impacts and recognition that action is necessary to lessen impacts and improve environmental protection. They are, however, only leading or predictive indicators of improved protection. The regulatory baseline for awareness and commitment is knowledge of environmental regulatory requirements and a commitment to abide by those requirements. A second baseline is the level of awareness and commitment prior to EMS implementation. Understanding the processes for changing awareness and commitment at an organization is important for knowing 'how' an EMS can improve environmental protection.

Environmental Policy

The environmental policy is one element of an EMS that expresses commitment. The environmental policies of each of the pilot projects are included in Appendix I. At a minimum each policy includes the three commitments required by the ISO 140001 Standard, these are commitments to compliance, the prevention of pollution, and continual improvement.

A commitment to compliance implies an intent to meet the regulatory minimum; however, even with this commitment some pilots went beyond a simple statement. For example Benziger Family Winery, Anheuser-Busch, and Central Marin Sanitation Agency commit to comply with the letter and spirit of law and regulation.

Prevention of pollution is the second general commitment included in the pilot's environmental policies. The ISO 14001 EMS standard defines this term as the use of processes, practices, materials or products that avoid, reduce or control pollution, which may include recycling, treatment, process changes, control mechanisms, efficient use of resources and material substitution. The term therefore encompasses activities that might be regulated like pollution control or treatment and could include non-regulated

activities including recycling and others traditionally considered pollution prevention. Pollution prevention (P2) on the other hand means "source reduction," as defined under the federal Pollution Prevention Act[20], and other practices that reduce or eliminate the creation of pollutants through:

- Increased efficiency in the use of raw materials, energy, water, or other resources, or
- Protection of natural resources by conservation.[21]

The pollution prevention definition specifically excludes recycling.

In California, the Hazardous Waste Source Reduction and Management Review Act of 1989 requires pollution prevention planning for hazardous waste generators that meet certain criteria. The EMS study did not complete a detailed analysis of the requirements of the California law and activities of the EMS pilots.

Because prevention of pollution, as defined in ISO 14001, includes pollution control and recycling, examples of pilot commitments that pertain to pollution prevention are discussed in order to describe commitments that exceed regulatory commitments. Each of the pilot's environmental polices included commitments that would be considered pollution prevention. For example, IBM commits to "ensure the responsible use of energy throughout our business, including conserving energy, improving energy efficiency, and giving preference to renewable over nonrenewable energy sources when feasible." Central Marin Sanitation Agency (CMSA) redefines prevention of pollution to mean avoiding or reducing environmental pollution produced directly from CMSA operations, as well as avoiding or reducing pollution produced indirectly by the consumption of power, fuel, chemicals, and other resources by CMSA. Artistic Plating states, "We will seek ways to more efficiently use, in our production operations, all of the available resources and process materials." Davis Bynum Winery shall, "Find new ways to minimize our dependency on non-renewable energy as well as natural resources." LM Aero – Palmdale commits to integrate Environmental Health and Safety considerations into the design process and business decisions.

The third general commitment is to continual improvement. ISO 14001 defines continual improvement as the process of enhancing the environmental management system to achieve improvements in overall environmental performance in line with the organization's environmental policy. There is no regulatory requirement for continual improvement. Performance improvements may be mandated by the state through toughening emission or discharge standards; however, continual improvement in the context of an EMS relates to an organization improving the system in order to achieve greater performance. IBM goes beyond this definition and commits to "continually

[20] The federal Pollution Prevention Act of 1990 defines "source reduction" as any practice which reduces the amount of any hazardous substance pollutant or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

[21] US EPA, August 2001, "An Organizational Guide to Pollution Prevention" (EPA/625/R-01/003)

improve IBM's EMS *and performance* (emphasis added)." Similarly, Benziger Family Winery commits to, "Continually monitor and improve environmental performance through an EMS." The concept of continual improvement is important in understanding the potential for EMSs to influence change in environmental protection at an organization.

The environmental policy is also a vehicle for building awareness. The environmental policy provides a forum for an organization to express values, aspirations, goals, and behavioral expectations. With a few exceptions, no formal communication of this sort was present prior to EMS implementation. The ISO 14001 standard requires that the environmental policy is communicated to all employees and made available to the public.

While an environmental policy does not guarantee improved environmental protection, the policy is important in establishing a culture of environmental protection and is the basis for behavioral change and increased accountability. A few examples for environmental policies illustrate this. LM Aero – Palmdale's policy begins with "Responsibility for Environmental Safety and Health is everybody's business!" This one statement illustrates the central theme of LM Aero – Palmdale's EMS; integration of environmental and worker protection throughout the organization. Anheuser-Busch provides another example. The final sentence in Anheuser-Busch, Fairfield's policy is, "Each employee will comply with this policy – neither production goals nor financial objectives shall excuse noncompliance."

The environmental policy is not the only EMS element that acts to improve an organization's awareness or knowledge and understanding of environmental impacts and legal requirements. Many pilots increased their understanding of legal requirements as a result of EMS implementation. For example, to create a regulatory checklist and procedure for updating knowledge of legal requirements in fulfillment of ISO14000, Pentel invited environmental regulators into the factory to inspect the facility and operations. As a result, Pentel became aware of the South Coast Air Quality Management District Solvent Rule, the State Water Resources Control Board stormwater management requirements, and additional hazardous waste disposal and source reduction planning requirements of the Department of Toxic Substances Control. Upon becoming aware of these requirements, Pentel made the changes needed to comply and implemented a regulations compliance database.

Aspects and Impacts

A sound and valid inventory of aspects and impacts are good indicators of awareness and commitment. An environmental aspect is an element of an organization's activities, products, or services that can interact with the environment. Significant aspects are those activities that can have a serious impact on the environment and are determined by the pilot based on a self-established standard methodology. The ISO 14001 standard requires that significant aspects are identified. The process of determining which aspects are most significant can increase an organization's awareness and understanding of environmental impacts. For example, LM Aero – Palmdale's

procedure for determining whether an aspect has significant impact considers geographic scale of the impact and relative risk. The aspects consequence on local, regional, or global ecology is evaluated and ranked as either having low, medium or high risk. The significance determination allowed pilots to rank the importance of an impact and then prioritize their response.

An organization's significant aspects may or may not be regulated. Environmental awareness limited to environmental impacts that are legally regulated is considered the regulatory baseline for this indicator. Table 3 below shows for each pilot the number of significant aspects identified by the pilot that relate to either a regulated or non-regulated negative environmental impact. The table illustrates whether awareness of the pilot's impacts extends beyond those impacts that are addressed through regulation.

The number of aspects identified for each pilot demonstrates that awareness does extend beyond regulated impacts. While pilots identified significant aspects in regulated areas such as air, water, and hazardous waste, they also identified aspects in non-regulated areas, for example air (unregulated emissions and green house gases), water use, solid waste, resource consumption, habitat, traffic, and product use. For pilots like Artistic Plating, San Diego, IBM, and LM Aero – Palmdale the majority of aspects were found in regulated areas. Environmental aspects for Anheuser Busch, Pentel, Davis Bynum Winery and Benziger Family Winery on the other hand are primarily non-regulated. This table illustrates that the pilot's awareness of their environmental impacts extends beyond the impacts identified and managed through regulation.

For pilots that are registered to the ISO 14001 standard (A-B I, San Diego, IBM, and Pentel) significant aspects also reflect environmental commitments. The ISO standard requires that the organization identify those operations and activities that are associated with significant aspects and shall plan these activities in order to ensure they are carried out under certain conditions. This includes establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy and the objectives and targets. This requirement creates a new set of internal requirements that the organization must follow whether or not the aspect is externally regulated. Pilots with unregistered EMSs also established procedures and set objectives and targets that considered significant aspects. Through the management of non-regulated aspects organizations can increase protection of non-regulated impacts. Many significant aspects are activities that are not regulated like the use of energy and water, solid waste generation, or employee transportation.

Table 3: Number of Aspects for Regulated and Non-Regulated Negative Impacts as Identified by Pilot Project

Pilot	Number of Aspects related to Regulated Impact				Number of Aspects related to Non-Regulated Impacts					
	Air	Water	Haz. Material or Waste	Health & Safety	Air	Water	Solid Waste	Energy	Material Input	Other
A-B, I	5	0	0	2	0	5	5	5	5	Natural Resources
Artistic	2	3	1	NA	0	1	1	0	1	None
CMSA	2	1	1	NA	0	1	1	2	0	None
San Diego[1]	8	5	2	NA	1	1	5	1	2	Noise, heavy equipment traffic, land contamination
IBM	3	3	4	NA	1	2	1	1	4	Transportation, products
LM Aero	10	11	15	8	5	4	4	2	2	Contractor Management
Pentel	1	1	5	NA	7	2	9	8	4	None
Davis Bynum	0	1	5	NA	12	13	13	2	14	Extraction of resource, forest habitat
Benziger	2	4	9	NA	13	11	15	2	15	Extraction of resource, forest habitat, noise

Objectives and Targets

Objectives and targets are another measure of commitment by identifying what an organization is committed to achieve and by when. Table 2 in the Pilot Project Reports (Appendices A – H) identify objectives and targets, their status, and whether the objective will meet or exceed regulated requirements, or if the objective is in an area that is non-regulated. An Environmental Performance Summary Table, located immediately after the executive summary, reports the principle objectives and targets for each pilot project and their status. The following are some observations taken from these tables.

- The majority of objectives are set for non-regulated activities.

- Many pilots set pollution prevention objectives for hazardous waste, and while hazardous waste is regulated, there are no limits regarding its generation.
- Some objectives exceeded regulatory management requirements, for example establishing standard operating procedures.
- Only one pilot, Artistic Plating, specifically set objectives to exceed mandated performance limits.
- Most pilots met many of their objectives; however, a considerable number of objectives were not met.

Many pilot projects reported significant progress towards at least some of their objectives and targets. The process of setting and then working towards objectives and targets appears to greatly affect environmental performance. Several projects reported results significantly beyond their stated objective (Artistic, Pentel, LM Aero, and San Diego). In one example at Pentel, several departments exceeded both electrical and solid waste reductions by several orders of magnitude over original targets.

Systems Management of Environmental Impacts

Systems Management of Environmental Impacts refers to the ability of an organization to better protect the environment through more mature and effective systems of environmental management. This refers to the programs and processes an organization uses to meet regulatory requirements, follow their environmental policy, make progress towards objectives and targets, measure and review performance, and adjust to foster continual improvement. To identify improvements in management systems Cal/EPA analyzed the relationships between the environmental policy, significant aspects, objectives and targets and other elements of an EMS that act within the Plan-Do-Check-Act cycle. Also analyzed were the implementation programs, processes for monitoring and measurement of environmental performance, and processes for review, corrective action and continual improvement. This analysis helps in understanding whether an EMS can improve environmental protection by illustrating more effective systems of environmental management and in doing so help identify 'how' an EMS can improve public health and environmental protection.

The relationship between the various elements of an EMS is one indicator of a more systems approach to environmental management. In other words, are there connections within the Plan-Do-Check-Act EMS cycle? Davis Bynum's EMS illustrates this connection. Their environmental policy states that they must be aware of significant environmental impacts of all aspects within their control. Elements within their policy are considered when determining significance including the following:

- Find new ways to minimize our dependency on non-renewable energy as well as natural resources;
- Continually minimize our export of solid waste;
- Continue our commitment to organic growing methods; and
- Pursue the goal of no harm to people and the prevention of pollution.

Davis Bynum went on to identify 40 significant aspects of the winery and vineyard operations including the use of electricity and water. Two primary objectives set were to increase monitoring of these resources, establish baseline data, and reduce usage by ten percent in 2003. They have implemented specific programs to meet these objectives, including installing and monitoring several new electric and water meters. Davis Bynum now has the ability to monitor progress, determine whether objectives are being met and make adjustments to their system for better performance.

In order to meet objectives and manage significant aspects pilots implemented several types of programs and processes within their EMS; these include operational controls, training programs, employee involvement and communication, emergency preparedness, compliance assurance, pollution prevention, and health and safety. LM Aero – Palmdale's chemical control program will be described to illustrate how one program, which provides operational control and monitoring, can improve environmental protection. The pilot project reports contain numerous other examples of improved systems for environmental management.

The following example illustrates LM Aero – Palmdale's system for managing and monitoring the use of chemicals, a significant aspect. The major elements of LM Aero – Palmdale's chemical control program involve the Chemical Control Board (CCB) and the chemical control cribs. The CCB is made up of people from each department at LM Aero – Palmdale and has two main responsibilities; identifying pollution prevention projects and approving all chemical purchases. Chemical review includes an analysis of the environmental health and safety risk involved with the chemical, the need for the chemical, and a search for less toxic alternatives. The CCB helps integrate the EMS into design and purchasing business functions.

The daily use of chemicals at LM Aero – Palmdale is monitored and managed through a system of chemical control cribs whose purpose is to dispense chemicals and monitored their daily usage. The employee and the chemical package are identified and the package is weighed before and after each shift. Combined with the approval process of the CCB, the cribs ensure that no unauthorized chemicals are being used. Pollution prevention programs are monitored using the cribs and the system helps reduce chemical usage and waste by ensuring that only necessary amounts of chemicals are provided to employees. The accounting also allows LM Aero to meet the daily volatile organic compound tracking requirements of the Antelope Valley Air Pollution Control District and the Los Angeles County Fire Department requirement for reporting hazardous material use. Chemical control programs help LM Aero – Palmdale meet regulatory requirements and exceed requirements by limiting, reducing and controlling allowable chemical usage.

Through EMS implementation, Artistic Plating realized that meeting the minimum regulatory monitoring requirements were inadequate for providing adequate management of air emissions from chrome plating baths. Surface tension in the chrome bath has a direct impact on air quality, therefore Artistic is measuring surface tension daily, rather that weekly as the regulations require. The regulatory requirement

for surface tension in the chrome bath is 45 dynes/cm square. In 2000 surface tension averaged 33 dynes/com squared and 29 dynes/com squared in the first six months of 2001.

Communication and Information Technology

EMS implementation often resulted in improved internal communication and employee understanding of job responsibilities and the environmental impacts of not performing jobs correctly. At Artistic Plating, environmental responsibilities were written into job descriptions and environmental criteria were included in job appraisals. This was accomplished by tying training and other forms of information to elements of the EMS such as the environmental policy, significant aspects, objectives and targets and environmental performance. Examples of communication programs include environmental and safety committees, bulletin boards, and job hazard assessments. These changes helped establish new cultures of environmental awareness and responsibility on the part of employees and management.

Information technology played an important role in implementing, maintaining, and improving EMSs at the larger facilities with mature EMSs. Good information technology, such as internal web sites and email, appears to be critical for the implementation of complex EMSs at large facilities. Anheuser-Busch, Lockheed Martin and IBM all use internal web sites and other technologies to implement their EMSs. Information technology may also help smaller organizations implement EMSs.

Compliance Assurance and Continual Improvement

Systems for compliance assurance are illustrated through the audit and review process used by Anheuser-Busch in Fairfield. The following example also illustrates systems for review, corrective action and continual improvement. This program helps A-BI maintain compliance and adhere to their ISO certified EMS. A-BI established its environmental audit program in 1981 and it has evolved over the years. Currently, teams of corporate environmental staff, on-site environmental staff, and external consultants conduct audits at each facility. Facility Environmental Liaisons have been created to help communication between the corporation and the facility. The frequency of facility audits is based on risk. Previous audit results, the number of fines and penalties incurred, and the existence of sensitive issues are all factors that influence the audit schedule. Facilities are typically audited every two to five years. A facility compliance self-assessment program has also been implemented in order to identify potential and actual non-conformances with laws and internal and non-regulatory requirements. Regardless of how a non-compliance with a regulation or internal requirement is discovered, a corporate procedure has been developed to address, mitigate, and quickly correct the nonconformance. The procedure consists of two main programs. The Environmental Issues Status Report is used to address and track the timely correction of the nonconformance with the law or internal requirements. Root-cause analysis is used to mitigate recurring nonconformance with the law or internal requirement. A root-cause analysis is a process whereby the cause of a particular accident or non-compliance is determined.

LM Aero – Palmdale's system for review and continual improvement has evolved with the development of their EMS. Prior to EMS implementation senior management was not aware of the amount of hazardous waste generated by the company. LM Aero – Palmdale now requires that root-cause analysis and corrective action be conducted for any nonconformance identified in an audit or review. Through this process LM Aero – Palmdale identifies issues and directs corrections to continually improve their EMS. Also, involving senior management and the President in the EMS review helps meet an Environmental Policy commitment to integrate EHS management practices into business decisions. Further, senior management establishes new objectives and targets based on information provided in the reviews. Meeting these objectives and targets is now tied to economic compensation in the form of bonuses and merit pay increases for management.

Environmental Performance Indicators

Environmental performance is measured through key indicators and is the most direct way improved environmental protection is measured in the EMS pilot project. The EMS Pilot Project compared environmental performance data to two baselines, regulatory requirements and pre-EMS performance, to determine whether the pilot's EMS increases environmental protection. Performance as compared to objectives and targets was discussed previously in this report.

Comparisons between Pre and Post EMS Performance

Table 3 in the Pilot Project Reports describes pre and post EMS environmental performance for various indicators chosen by each pilot. If available, three years of baseline data and two years of post-EMS data are reported. Improvements in environmental performance were observed in some areas at all pilots reporting performance data. For the most part these gains can be described as pollution prevention successes in areas of significant environmental impact as determined by the EMS significant aspect process including hazardous and solid waste generation, air emissions, and resource use. Performance also declined or remained relatively constant in other areas at many pilots. Where improvement is observed the range varies between pilots, with some reporting significant change while others reported only moderate change. Performance at the pilot projects also varied between different media (i.e. improvements observed in some media, while no improvements or reductions observed in other media). CMSA and the wineries had not implemented their EMS; therefore, performance data is not available. The following paragraphs report several examples to illustrate points made above.

Anheuser Busch, Inc. (Appendix A)

Data back to 1990 is available for Anheuser Busch, with 1990 to 1992 representing baseline years. Table 3 in the pilot project report shows several fluctuations in data during these years; however, a comparison between the most recent year 2000 and baseline years reveal modest gains in some indicators others showed significant improvements. Toxic releases of ammonia were reduced from 22.81 pounds per BBL (barrel) packaged to 6.71 pounds per BBL in 1999. Solid waste to landfill was reduced

from a high of 1471 pounds per million BBL packaged to 736 pounds per million BBL packaged. Indicators like wastewater flow, sewer Biologic Oxygen Demand and Total Suspended Solids, Resource Conservation and Recovery Act (RCRA) Hazardous Waste, fuel and energy use remained relatively stable during the reporting period.

Artistic Plating (Appendix B)

Artistic Plating illustrates the potential improvements for a facility with a recently implemented EMS. During the second year of their EMS Artistic Plating eliminated perchloroethylene by replacing it with an ultrasonic aqueous parts cleaning tank. This elimination was not required by regulation.

Artistic also saw gains in reducing copper discharge to the sewage treatment plant. In the baseline years (1995-1997), copper measured 0.012, 00.019 and 0.025 milligrams per liter (mg/l) per employee. In 2000, copper discharges were 0.003 mg/l per employee and in the first six months of 2001, they were 0.007 mg/l per employee (Table 3, Pilot Project Report). Actual discharge in 2001 was 0.73 mg/L. This figure far exceeds their permit limit of 3.00 mg/L (Table 4, Pilot Project Report). Several things were done to facilitate these reductions. First, the wastewater treatment process was monitored more closely; second, the pre-treatment process was evaluated and readjusted; and third, the wastewater discharge was monitored using spectrophotometry equipment twice daily. This is an example of improved performance resulting from system improvements.

A third example at Artistic is sludge. During the three baseline years (1995-1997) sludge measured 511, 705, and 750 pounds per quarter per employee (lbs/qtr/employee) (Table 3, Pilot Project Report). Sludge volume actually increased to 811 lbs/qtr/employee during 2000 as a result of adding a new hoist line and increased production. However, by the next year sludge volume was reduced to 451 lbs/qtr/employee. This reduction is attributed system improvements including the addition of water flow restrictions to the hoist line, adding conductivity sensors in rinse tanks, using techniques to reduce dragout, and improved wastewater operation and monitoring. There are no regulatory restrictions on sludge volume.

San Diego MWWD, O&M Division (Appendix D)

San Diego (Appendix D) focused their improvement efforts primarily on non-regulated aspects. Electricity, potable water use, refuse disposal and chemical use were non-regulated aspects targeted for reduction by San Diego. Five-percent reductions were set for each area (Table 2, Pilot Project Report). Electricity was reduced by 5% or from 9801 to 9281 megawatt hours per month (MWhrs/Month). A 6% reduction was realized for potable water use (39759 to 37373 hundred cubic feet). Monthly refuse removal was reduced from 26.65 to 21.65 tons per month or a 19% reduction. Chemical usage declined 13% from 1269 different types of chemicals to 1093.

IBM (Appendix E)

The EMS at IBM is another that evolved over several years, thus diminishing the value of baseline data reflecting true pre-EMS conditions. However, much can be said about

their performance during the study period. Performance at IBM can be characterized by increased efficiency, which allowed total performance to remain relatively constant while production increased. Between 1994 and 2000, IBM saw wastewater discharge decrease from 5.6 million gallons per million units produced in 1994 to 2.16 million gallons per million units produced in the year 2000. Actual water discharge during that period increased slightly. Water use is a similar example. Gains in water efficiency allowed total use to remain relatively unchanged even though production increased. In 1994, water use was at 3.8 million gallons per million units produced. This figure was reduced to 1.37 million gallons per million units produced in 2000. Pollution prevention gains in hazardous waste generation allowed IBM to greatly increase production without increasing waste generation. In 1994, 1,704 tons of hazardous waste were generated. This equals 46.1 tons per million units produced. Hazardous waste generation increased in 2000 to 1,877 tons; however, per million units waste generation was reduced to 18.6 tons. IBM saw a huge increase in Toxic Release Inventory (TRI) air emissions in 1995 due to increased production and the addition of N-methyl-2-pyrrolidone to the TRI list. Since 1995, however, TRI air emissions have steadily decreased from7,210 pounds, or 114 pounds per million units produced to 4,000 pounds, or 39.6 pounds per million units produced in 2000.

LM Aero – Palmdale (Appendix F)

LM Aero – Palmdale provides an example of a mature EMS that has evolved over the last decade and has had considerable success in reducing toxic releases. While baseline data for this study are 1996, 1997 and 1998, LM Aero – Palmdale considers 1992 as the beginning of their EMS and use 1991 as a baseline. The 1996 – 1998 baseline was selected because it reflects performance prior to LM Aero – Palmdale self-certifying compliance with ISO 14001 in 1998.

Hazardous waste generation at LM Aero – Palmdale has been a focus of their EMS from its earliest beginnings. From 1996 to 2000, total hazardous waste generation was reduced from 1,084,000 lbs. to 628,000 pounds, or a 42 percent reduction. Normalizing the data to per 100 employees translates to a 26 percent reduction over those years. When compared to the 1991 baseline of 7,384,000 pounds the reduction equals a 91 percent reduction in hazardous waste generation.

Volatile Organic Compounds (VOC) emissions to the air are another indicator of the LM Aero – Palmdale's environmental performance. Large reductions in VOC emissions were seen in the early 1990's. These represent a transition from organic degreasers to primarily aqueous cleaners. In 1990, the Skunk Works facilities in Palmdale and Burbank generated 256,000 pounds of VOC combined. In 1991 that figure had been reduced to 103,000 pounds. In 1994 LM Aero- Palmdale made a complete switch to aqueous degreasers. Since 1994, VOC emissions have fluctuated with a low of 35,691 pounds in 1997. VOC emissions for the year 2000 were at 49,286 pounds. This actually represents a 50 percent increase in VOC emissions per 100 employees from the 1996 baseline year. LM Aero – Palmdale's inability to affect VOC performance post 1994 is a reflection of technical barriers and the nature of LM Aero – Palmdale's operations. Aircraft painting generates much of the VOC emissions and although the

number of personnel has stayed relatively constant, the number and size of aircraft varies greatly each year. Finding less polluting substitutes is also difficult because LM Aero must meet military specifications. Because of these difficulties, LM Aero – Palmdale had not set VOC objectives in the past; however, their 2001 EMS established the Environmental Aspect Risk Reduction Initiative. This initiative targets specific processes, rather than numeric performance objectives, in the hopes of finding technical breakthroughs. For example, in 2001 LM Aero – Palmdale set a new objective to eliminate the use of Methyl Ethyl Ketone (MEK). They are also experimenting with a non-VOC topcoat for the Joint Strike Fighter.

Pentel (Appendix G)

Prior to implementing their EMS Pentel collected little environmental data, therefore only one year of data (2000) is available as a baseline. As a result, Table 3 was not completed. Instead, Pentel's post EMS performance is reported on Table 2 in comparison to their objectives and targets as well as in the text. Pentel achieved significant performance improvements during the short time their EMS has operated. Emissions of volatile organic compounds have declined as particular solvents have been eliminated or dramatically reduced. Specifically, use of alcohol for general cleaning of plastics has been discontinued to comply with the South Coast Air Quality Management District's Solvent Rule. Volatile organic compound threshold exemptions expired at the end of year 2000. As Pentel can no longer use methanol to clean product, they substituted an exempt cleaner, methyl acetate, then subsequently converted to use of deionized water. While a target for 5% reduction of D-309, a solvent allowed for use in screen printing, was set, a 25% reduction was achieved.

Four of the six departments that set electricity reduction targets achieved or exceeded their target. One department set a reduction target of 1% electricity savings from lighting and achieved a 27% reduction by disconnecting unnecessary light bulbs. Another department achieved its target of 5% electricity use reduction from fluorescent lighting by installing a switch. Two departments that set production efficiency targets as indicators of electricity efficiency did not achieve their targets. Two departments that set electricity conservation targets for specified areas (3% and 5% targeted reductions) met and exceeded their targets (20% and 13% actual reductions).

Pentel has also achieved the following performance improvements.

- Plastic Scrap – 2.8 to 1.9 million pieces per month
- Oily Wastewater – 253 to 82 gallons per month
- Absorbent – 250 to 50 pounds per month
- Metal Bearing Wastewater – 600 to 159 gallons per month
- Waste Ink – 41 to 24 gallons per month

Comparison of Performance to Regulatory Standards

A comparison of environmental performance against regulatory limits was used to determine whether increased environmental performance beyond current regulatory requirements resulted from EMS implementation. Table 4 in the Pilot Study Reports compares environmental performance to permitted air emission or wastewater

discharge levels. The table also identifies any objectives and targets that are related to the emission requirement. Three pilots Artistic, IBM, and Lockheed Martin provided this data. Local Pretreatment Program requirements for these three pilots and the last year of their performance data corresponding to those requirements are shown on Table 6 below. Other regulatory requirements are identified in Table 4 of the Pilot Project Reports; however, numerical limits are not reported. The only pilot to report quantitative air emission was LM Aero – Palmdale. While yearly Volatile Organic Compounds are capped at 114 tons per year, LM Aero – Palmdale yearly emission were between 18 and 24.6 tons.

Table 4 below shows that average monthly discharge levels at each of the pilots were substantially below their permit requirements. Although Table 4 demonstrates performance in excess of permitted requirements, it is difficult to understand the role of their EMS in reaching that performance level since the pilots performed similarly during the pre-EMS baseline period (Table 4, Pilot Project Reports). Further complicating the data is the fact that IBM and LM Aero – Palmdale had some form of an EMS during the baseline period. Therefore, the only conclusion that can be made is that the pilots were able to perform at levels below regulatory limits while they had EMSs in place.

Table 4 in the Pilot Project Reports also identifies any objectives and targets related to the regulated emission. Only Artistic Plating set objectives to specifically better their regulatory limit. Artistic Plating set an objective to reduce cyanide concentrations in wastewater discharge 50% below their permitted levels and reduce chromium by 10% over the 2000 monthly average. These goals were set to provide a compliance buffer and help ensure that Artistic would not exceed permit limits. IBM on the other hand considered these aspects under operational control, within limits and properly managed, and therefore did not set any performance objectives. LM Aero – Palmdale's objective is to maintain compliance with their permits.

Although specific air emission permit levels are not reported (with the exception of LM Aero VOC limits) similar objectives (i.e. to maintain compliance) were established for those aspects. LM Aero – Palmdale is targeting air emissions; however, instead of setting quantitative goals LM Aero – Palmdale now targets specific chemicals for elimination in hopes of finding technical breakthroughs rather than incremental improvements.

The data suggest that a performance threshold may have been reached for permitted wastewater discharges and air emissions. The threshold may be caused by technical limitations of the treatment systems, a reduction of risks to levels of insignificance, a belief that compliance is sufficient, or a reluctance to set performance objectives below regulatory limits. Better understanding of the role of permit levels in limiting performance improvements is needed.

Table 4. Local Pretreatment Program Requirements, Monthly Averages

Permitted Emission	Artistic Plating		IBM		LM Aero – Palmdale	
	limit	2001	limit	2000	limit	2000
Cadmium	2.61	Non Det.	.07	<0.005	0.02	<0.005
Chromium (total)	2.00	0.37	1.0	0.005	0.42	0.0053
Copper	3.00	0.73	0.05	0.01	0.51	0.013
Cyanide (total)	1.2	0.13	1.0	<0.05	0.18 CN	<0.025
Gold	0.43	Non Det.				
Lead	0.69	Non Det.	0.4	<0.05	0.11	<0.005
Nickel	3.98	0.51	0.10	0.016	0.61	<0.01
Silver			0.7	<0.02	0.07	<0.01
Zinc	3.98	0.35	2.6	0.27	0.40	0.035

Compliance

The EMS project attempted to measure compliance improvements through changes in regulatory violations. The method for determining compliance improvements consisted of documenting violations whenever regulatory inspections were conducted at the pilots. Special inspections were not requested as a part of the pilot project. In the case of Pentel, the facility sought to have regulatory inspections in order to identify any deficiencies and understand all their requirements. The data collected during the pilot did not reveal significant changes in compliance as a result of EMS implementation. For example, Anheuser Busch showed no violations during the baseline and update periods. Pilots with violations during the study period were only given minimum fines. These fines were usually associated with lab testing. Artistic Plating for example had 8 violations during the baseline years of 1995, 1996 and 1997 and was fined a total of $2,577. Artistic had no violations in 1999 while in 2000 they had three violations and were fined $1,635. All of these fines were associated with lab testing fees. No punitive fines were levied. San Diego was cited 5 times after EMS implementation (between 1999 and 2001) and fined approximately $7000. San Diego reported only two violations and a total of $750 in fines during the baseline period. IBM had 2 minor violations during the baseline year of 1996 with no penalties and 1 minor violation in 2000 with no penalties. Pentel had 4 minor violations after they invited regulators into the factory in 1999; however, no violations have been discovered since.

Perhaps the greatest improvement in pre and post EMS compliance status was seen in LM Aero – Palmdale. In 1989, the Skunk Works was fined $1.5 million by OSHA and $1 million by the South Coast Air Quality District. The California Department of Toxic Substances Control levied a $50,000 fine for hazardous waste violations in 1990. That same year, the US Environmental Protection Agency issued a $400,000 fine. During the study period LM Aero – Palmdale did experience a few minor regulatory non-compliances. In 1998, the Los Angeles County Sanitation District cited LM Aero – Palmdale for a single chrome exceedence in their discharge. LM Aero – Palmdale was not able to identify the source of the chrome and no fines were levied. They were also

cited by the California Department of Health Services for detected coliform in a water well. A contractor who failed to de-contaminate the well cover caused the problem. Again, no fines were levied. An incorrect water sampling method was the cause of their only non-compliance in 2000. A 24-hour composite sample was collected instead of a grab sample and resulted in sulfides building up in the wastewater sample. Notices of Violations were not issued for these occurrences, nor were any fines. These non-compliances are insignificant compared to the pre-EMS compliance history.

Trends in Environmental Performance Improvement

The data discussed above reveals several trends in environmental performance improvement. Pilots who are still in the process of implementing their EMS have not reported gains in environmental performance improvement. The Sonoma County Wineries and CMSA are still in the process of establishing the management programs even though objectives have been set. San Diego and Pentel, however, are experiencing significant improvements and still show great potential for future gains. The pilots with mature EMS on the other hand, Anheuser-Busch, IBM and LM Aero – Palmdale show signs of reaching performance limits. The rate of hazardous waste reduction at LM Aero – Palmdale has significantly slowed and they now have directed efforts at eliminating problem chemicals, rather than simply reducing the use of those chemicals. At Anheuser-Busch environmental performance indicators like wastewater flow and load, hazardous waste, fuel and energy use remained relatively stable during the project period. Anheuser-Busch, however, has been focusing on improving performance since the 1980s. IBM had been able to increase efficiency; however, performance metrics have also remained relatively stable.

The above examples imply that generalizations can be made in the change of environmental improvements over time. Theoretically, improvement in environmental protection can be graphically represented by an 'S' curve (Figure 3). The graphic below can represent either overall improvements of an organization, or specific improvements in a single media or indicator such as water use. During the early stages of EMS development and implementation, an organization must overcome challenges that act to inhibit the system's development and impact the resulting level of environmental protection. As these challenges are overcome and the system is implemented, environmental protection advances. Improvements will continue until barriers for continued improvement, or thresholds of the system are reached.

Barriers are system inhibitors that act to limit continued performance improvements. Several types of barriers may act to stabilize environmental improvements. Barriers may be technical or economic in nature, for example the absence of an acceptable substitute for a hazardous material. Barriers may also be socially created such as setting goals based on acceptable regulatory emissions levels, or the achievement of goals without further goal setting. Some organizations may choose to move on to other environmental issues once an objective for a particular impact is reached or diminishing returns are indicated. In order for environmental improvement to continue the system must be adjusted in order to breakthrough the barrier and establish a new period of continual improvement (Figure 4).

A third scenario is that environmental performance may actually backslide once a barrier is met. Backsliding may indicate major problems in the operation of an EMS. Changes in personnel, direction of an organization, or neglect can cause performance to backslide (Figure 5).

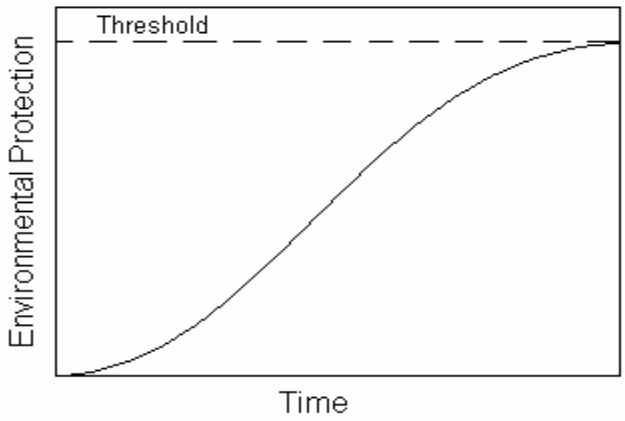

Figure 3: Continual Improvement with Single Barrier and Performance Threshold

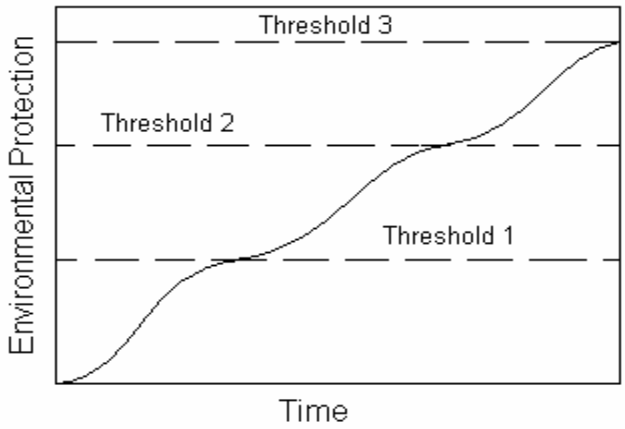

Figure 4: Cycles of Thresholds and Breakthroughs

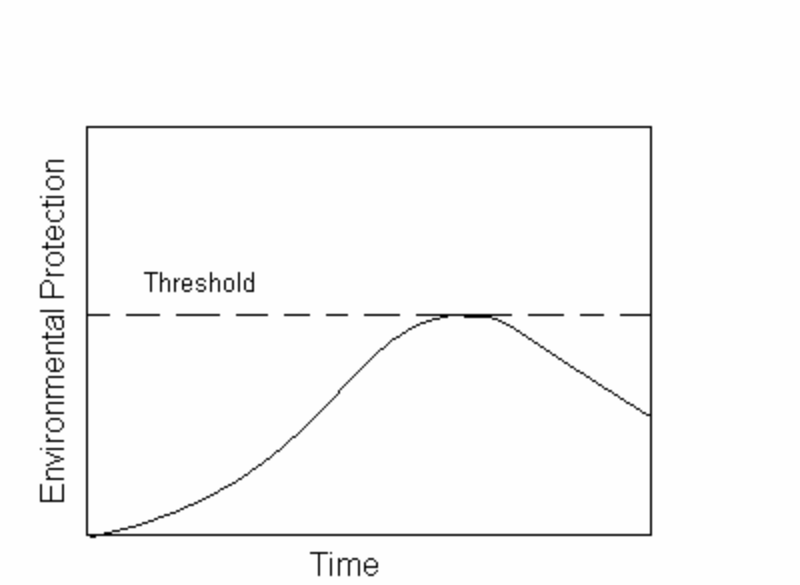

Figure 5: Performance Backsliding

The above graphs help identify periods in EMS development where assistance or intervention may help overcome barriers to environmental improvement. Several barriers or inhibitors are at work during the initial phase of EMS development. Interested stakeholders such as government agencies, communities, academics, or others in industry may play a role to help overcome these barriers by providing technical or financial assistance, or other motivations. At the other end of the curve, inhibitors that limit environmental improvement may also be targeted to help achieve breakthroughs that result in another continual improvement cycle. The graph illustrates that leverage points exist at the two opposite ends of the continual improvement cycle. Leverage points exist at the beginning when early challenges to system development must be overcome and at the end of the cycle when the limits act to slow or stabilize improvement. The possibility of performance backsliding indicates that monitoring, maintenance and vigilance is required for any EMS.

Summary

The data collected during the EMS pilot project supports the conclusion that EMS can have a positive effect on environmental protection and increase protection above that provide by a regulated entity's current regulatory requirements. Significant improvements in environmental protection were observed in most of the pilot projects. Pilot organizations demonstrated increased awareness of their environmental impacts and responsibilities through aspect and impact assessment and through the identification of legal and other requirements. Their Environmental Policies and objectives and targets established greater commitments to environmental protection than was observed prior to EMS implementation. These changes established a basis for further system changes and improved performance.

Improved systems for managing environmental impacts were observed in many of the pilot projects. System elements that were found to improve environmental protection include increased monitoring and measurement, operational controls, communication, training and specified environmental job responsibilities. Systems for compliance assurance included some or all of the following elements: improved monitoring, internal and external audits, management review, root cause analysis, corrective action, and preventive action. Pilot projects with mature EMSs created systems for continual improvement that included performance measurement, internal and external audits, management review, corrective action, and new objective setting. Information technology played an important role in implementing, maintaining, and improving EMSs at the larger facilities with mature EMSs.

Some improvement in environmental performance was observed at all pilots reporting performance data. This included all pilots except for Benziger, Bynum and CMSA, who did not yet have an EMS developed to the point of reporting performance data. The range of improvement, however, varied between pilots, with some reporting significant change (Artistic, LM Aero, Pentel, and San Diego) while others reported only moderate gains (A-BI and IBM). The vast majority of performance improvements were observed in non-regulated areas. With the exception of pollution prevention goals for hazardous waste and toxic releases, objectives and targets were more likely set for non-regulated media.

While no clear trend in compliance improvements was observed in the EMS project, many pilots had a better recognition of, and response to, compliance issues. In some cases, pilots who had no violations before the EMS was put in place, such as IBM, continued to have no violations afterwards. In other cases, pilots who had violations before the EMS, such as Artistic, had some violations after the EMS was put in place, but had better systems in place to respond to problems swiftly.

Compliance methodology consisted of documenting violations whenever regulatory inspections were conducted. Special inspections were not requested as part of the pilot project. However, in the case of Pentel, the facility sought out a regulatory inspection on their own accord, in order to identify any deficiencies and understand all their requirements.

Objective 2: Determine whether and how the use of an EMS by a regulated entity provides the public greater information on the nature and extent of public health and environmental effects than information provided by their current regulatory requirements.

In order to meet this objective we must first define what is meant by “nature and extent of public health and environmental effects of their activities or processes” and second, understand the baseline of information sharing as required by law and regulation. The nature of public health and environmental effects are the intrinsic characteristics or qualities of the environmental impacts of the organization’s actions. These qualities can include source, cause, type, quantity, severity, or risk. The extent of public health and environmental effects is the range or scope of the environmental impacts of the

organization's actions. The discussion below shall establish baseline public reporting requirements.

Establishing Regulatory Requirements

The regulatory baseline for public information is the public reporting requirements that provide the public with information on the nature and extent of the public health and environmental effects of their activities or processes. Below is a summary of the primary state and federal public reporting requirements. Reporting requirements included in state and federally issued permits are not included because these are too facility specific.

Air Toxics "Hot Spots"

The Air Toxics "Hot Spots" Information and Assessment Act (AB 2588, 1987, Connelly) was enacted in September 1987. The goals of the Air Toxics "Hot Spots" Act are to collect emission data, to identify facilities having localized impacts, to ascertain health risks, and to notify nearby residents of significant risks. Meeting these goals is the responsibility of the Air Resources Board and the regulated community. The following are key components of the Air Toxics "Hot Spots" program (California Air Resources Board: Overview of the Air Toxics "Hot Spots" Information and Assessment Act; www.arb.ca.gov/ab2588/overview.htm).

- The Act requires the ARB to compile and maintain a list of substances posing chronic or acute health threats when present in the air. Currently over 600 substances are subject to the program.

- The Act requires facilities meeting the applicability criteria to prepare air toxics emission inventory plans and, subsequently, emission inventory reports.

- Facility operators must submit to the local air district a proposed emission inventory plan indicating how emissions will be measured or calculated. The district must approve, modify, or return the inventory plan to the operator for revisions within 120 days.

- After reviewing emission inventory data, districts must rank facilities for purposes of risk assessment into high, intermediate, and low priority categories.

- Within 150 days of the designation of priorities, the operator of every facility that has been included within the highest priority category must prepare and submit to the districts a health risk assessment.

- Once the districts approve risk assessments, facility operators must notify all exposed persons of the risk assessment results if the district determines that there is a potentially significant health risk associated with emissions from the facility.

- Facilities determined to have a significant risk must conduct an airborne toxic risk

reduction audit and develop a plan to implement airborne toxic risk reduction measures.

Proposition 65: The Safe Drinking Water and Toxic Enforcement Act of 1986

Proposition 65 requires the Governor to publish a list of chemicals that are known to the State of California to cause cancer, birth defects or other reproductive harm. This list must be updated at least once a year. Over 700 chemicals have been listed as of March 10, 2000. Proposition 65 imposes certain controls that apply to chemicals that appear on this list. These controls are designed to protect California's drinking water sources from contamination by these chemicals, to allow California consumers to make informed choices about the products they purchase, and to enable residents or workers to take whatever action they deem appropriate to protect themselves from exposures to these harmful chemicals (Office of Environmental Health Hazard Assessment; Prop 65, In Plain Language; www.oehha.ca.gov/prop65/background/p65plain.html).

Any company with ten or more employees that operates within the State or sells products in California must comply with the requirements of Proposition 65.
Under Proposition 65, businesses are:

- Prohibited from knowingly discharging listed chemicals into sources of drinking water; and

- Required to provide a "clear and reasonable" warning before knowingly and intentionally exposing anyone to a listed chemical. This warning can be given by a variety of means, such as by labeling a consumer product, by posting signs at the workplace, or by publishing notices in a newspaper.

Federal Emergency Planning and Community Right-To Know Act (EPCRA) and Toxic Release Inventory (TRI)

The federal EPCRA's primary purpose is to inform communities and citizens of chemical hazards in their areas. Sections 311 and 312 of EPCRA require businesses who store hazardous chemicals in quantities equal or greater than 10,000 pounds or extremely hazardous substances in quantities equal or greater than 500 pounds or exceed the Threshold Planning Quantity (40 CFR, Part 355, Appendix A), to report the locations and quantities of chemicals stored on-site to state and local governments in order to help communities prepare to respond to chemical spills and similar emergencies.

EPCRA Section 313 requires EPA and the States to annually collect data on releases and transfers of certain toxic chemicals from industrial facilities, and make the data available to the public in the Toxics Release Inventory (TRI). In 1990 Congress passed the Pollution Prevention Act, which required that additional data on waste management and source reduction activities be reported under TRI. The goal of TRI is to empower citizens, through information, to hold companies and local governments accountable in terms of how toxic chemicals are managed (US EPA, “What is the Toxic Release Inventory (TRI) Program”, www.epa.gov/tri/whatis.htm).

California Hazardous Materials Business Plans

In California all industries and agricultural operations that store or handle a hazardous material in quantities equal to or greater than 55 gallons, 500 pounds, or 20 cubic feet of gas must provide the local environmental agency (Certified Unified Program Agency or other Administering Agency) hazardous materials business plan detailing the location and quantities of their hazardous materials. This information is then made available to emergency responders such as firefighters and medical personnel. Much of the information in the Business Plans is available to the public under the "right-to-know" provision of the law. The Business Plans are only available at the CUPA or Administering Agency. Business Plans must also contain an emergency response plan and employee training program.

Of the public reporting laws discussed above only Toxic “Hot Spots” provide information on both the nature and extent of the public health and environmental effects of their activities or processes engaged in by the regulated entity. The other requirements collect and provide information on the nature of public health and environmental effects, but not on the extent. Access to information varies with each program with the Toxic “Hot Spots” providing the most direct information to affected communities. Prop 65 also provides direct information to consumers and workers in the form of warnings. The State and Federal Community Right to Know laws provide access to information at the offices of the agencies. Toxic Release Inventory data is provided by US EPA through published reports and the Internet. Table 5 below summarizes whether and how the public reporting requirements discussed above address nature and extent and the public’s access to the information.

Comparing the environmental information (nature, extent, and access) provided to the public by the pilots as a result of their EMS to their legal reporting requirements will determine whether and how an EMS can provide greater information. To do this comparison Cal/EPA evaluated two indicators of increased information. These are:

1. The type of information generated by the EMS and the public’s access to that information.
2. Public and stakeholder involvement in EMS development, implementation and review.

Public and stakeholder involvement is included as an indicator because increased involvement implies greater communication between the pilot and its stakeholders.

Table 5: Information of Public Health and Environmental Effects Provided by Legal Reporting Requirements

Regulatory Requirement	Information on Nature	Information on Extent	Public Access to Information
Toxic "Hot Spots"	Source Type of Chemical, Amount Affect	In the form of Risk Assessment	Neighbors Notified by Facility
Prop 65	Source Type of Risk	No	Warnings posted on signs, labels or through notices
Federal EPCRA	Source Type of Chemical Emergency response plans	No	Available at Environmental Agency
TRI	Source Type of Chemical Amount	No	EPA Published Reports and on EPA website (www.epa.ca.gov/TRI)
Hazardous Material Business Plan	Source Type of Chemical Emergency response plans	No	Available at Environmental Agency

Types of and Access to Environmental Information

Table 6 in the Pilot Project Reports (Appendices A through H) summarizes the types of environmental information generated by the pilot, whether public reporting of the information is required, and the access or availability of the information. The list of information includes elements of an EMS, performance data, and regulatory reporting requirements.

Through EMS implementation, pilots generated new information that was not required by law or regulation. Environmental policies, aspects and impacts, and objectives and targets were created as a result of EMS implementation. These EMS elements provide new and potentially useful information about the nature of public health and environmental effects of the pilot's activities because they illustrate the pilot's awareness and understanding of risk and their commitment to control, reduce or eliminate risk. Internally, this type of information is important to the operation of the EMS by providing specific direction through policy, increased knowledge of impacts and responsibilities, and indicators to measure performance. Externally, this information can provide the public with greater understanding of the nature of risks and the actions being taken to mitigate those risks.

EMS information also, at least qualitatively, provides information on the public health

and environmental effects of their operations by identifying impacts that are local, regional, or global. The list of aspects and impacts generated by Davis Bynum, as an example, displays awareness of both the local impacts caused by winery operations and the off-site or indirect impacts from material or resource use. For example, impacts of electrical usage originate far from the winery and have regional or global effect. The impacts of many materials used in the winery are caused either in their production or disposal. Oak barrels, corks, glass, plastic, Styrofoam, and cardboard are examples. Aspects with local impacts like air emissions, water consumption, and surface water discharge are also included.

Table 6 of the Pilot Project Reports includes another set of information that involves environmental performance data. Information on compliance, waste generation, air emissions, water discharge and resource use are included in this category. With the exception of resource use, this information is similar or identical to information collected through regulatory programs. While performance data can provide information on the nature of public health and environmental effects, little, if any, information addresses extent of these effects.

Regulatory reporting requirements are also included on Table 6 of the Pilot Project Reports. This represents the baseline of public information sharing. Pilots met their regulatory requirements by reporting to the proper agency. Improvements in this area of information would consist of greater access or availability of the information to the general public. Anheuser Busch (www.abehsreport.com) and IBM (www.ibm.com/ibm/environment/annual/index.shtml) provide some of this information directly to the public on corporate web sites and annual reports. The information, however, is reported for the corporation as a whole and not for the individual facilities taking part in the pilot project. LM Aero – Palmdale does provide facility summaries of TRI and hazardous waste generation on their web sites (www.lmaeronautics.com/palmdale/esh/performance.html).

The mode of public access to environmental information, whether EMS, performance data, or regulatory reporting, is also presented on Table 6 of Pilot Project Reports (Appendices A – H). The use of annual reports and web sites by Anheuser Busch, IBM and LM Aero – Palmdale has already been discussed. All three of these companies are very large and have mature EMS. Although other pilots have web sites (San Diego, Pentel, Artistic Plating, Davis Bynum, Benziger, and CMSA) they were not used to provide environmental information. A few pilots (Artistic, Davis Bynum, Benziger, and San Diego) are willing to share a significant amount of environmental information with the public upon request.

Improved communication between LM Aero – Palmdale and emergency responders resulted from EMS implementation. An assessment of LM Aero – Palmdale's community right to know information for emergency response providers identified weaknesses in the accessibility of critical information. Information on hazardous materials types and location are reported through their Hazardous Materials Business Plan. This large paper inventory report may not be readily accessible to first responders

in a timely manner. Further, misinformation on rumors of "secret" chemicals raised fears amongst local fire fighters. In response, LM Aero—Palmdale gave seven seminars to 135 personnel from LA County, Kern County and US Air Force Plant 42 Fire Departments. Regular plant tours are also given to the two closest fire stations. LM Aero—Palmdale is also exploring ways to connect with the fire departments through a Geographic Information System. This system would provide electronic information on the location of chemicals and other hazards. LM Aero—Palmdale believes this would be a more useful product than the paper reports that they now submit.

EMS implementation at Pentel improved compliance with regulatory reporting requirements. When initiating their EMS, Pentel invited agencies to inspect their facility. Through this visit, Pentel learned that its Hazardous Materials Business Management Plan needed to be updated, and it was required to submit a Source Reduction Evaluation Review and Plan in accordance with SB 14 (Stats. 1989, Ch. 1218).

Stakeholder Involvement in EMS Implementation

The second measure of increased information was the level of public and stakeholder involvement in EMS development, implementation and review. Three types of stakeholder involvement were observed during the EMS project: Cal/EPA sponsored working groups, local advisory groups, and government involvement.

Cal/EPA established stakeholder Working Groups in both Northern and Southern California. Participation in one of those working groups was a requirement for inclusion in the pilot project. Working Groups were established to encourage stakeholder involvement and solicitation of their advice in meeting the objectives of the Cal/EPA pilot project. Through their participation with the Cal/EPA sponsored EMS Working Groups, pilot projects openly shared information about their EMSs with stakeholders. Shared information included environmental policies, significant aspects, objectives and targets, performance indicators, and some procedures. Working Groups visited each of the pilot's facilities. Interested businesses, non-government organizations, academics and government representatives participated in the Working Groups.

Local stakeholder groups were present at three pilots (CMSA, Wineries, and LM Aero – Palmdale). More focused stakeholder participation and input into EMSs occurred in local stakeholder groups as compared to the Regional Working Groups. Local groups were able to learn more details about the pilot's EMS and have greater opportunity to affect EMS development. Local groups also included stakeholders who were more likely to be directly affected by the pilot's activities. These stakeholders included local regulators and community activists.

At CMSA the Local Advisory Group (LAG) was instrumental in ensuring the continuation of the EMS. Early on in the creation of the EMS program at CMSA, the upper-level management elected to postpone development of the EMS due to conflicts regarding the impacts the EMS would have on plant management and operational procedures. The LAG members were concerned about a request by CMSA management to delay EMS implementation. The LAG spoke publicly at a CMSA Board meeting in support of

the EMS program at CMSA. They testified as to the positive impacts the EMS would have on the community and the anticipated environmental impact reductions. A representative from Cal/EPA also testified in support of continuing EMS implementation. The Board agreed with the LAG and Cal/EPA, and the Board directed CMSA management to continue EMS implementation.

Another important stakeholder in EMS development is government. Through the US EPA sponsored Merit Partnership Metal Finishing EMS Template project, Artistic Plating included US EPA in the development of its EMS. This direct government involvement strongly influenced the quality of the EMS by helping identify environmental impacts and establishing performance objectives that were consistent with U.S. EPA's goals. Cal/EPA was also involved in the development of the Sonoma Wineries EMS while producing a template for EMS implementation in the wine industry.

Summary

To meet this objective Cal/EPA first established a general baseline for environmental reporting requirements and evaluated whether these provide information on nature and extent of public health and environmental effects. Access to this information was also analyzed. The nature of public health and environmental effects are the intrinsic characteristics or qualities of the environmental impacts of the organization's actions. These qualities can include source, cause, type, quantity, severity, or risk. The extent of public health and environmental effects is the range or scope of the environmental impacts of the organization's actions.

The regulatory baseline for public information are those public reporting requirements that provide the public with information on the nature and extent of the public health and environmental effects of their activities or processes. Regulatory requirements evaluated included Air Toxics "Hot Spots", Proposition 65, the federal Emergency Planning and Community Right-to-Know Act, federal Toxic Release Inventory (TRI), and California Hazardous Materials Business Plans. Each of these requirements provides information on the nature of effects; however, only the Toxic "Hot Spots" begins to define extent of impacts. Toxic "Hot Spots" is the only requirement that provides direct information to the public. Proposition 65 provide generic warnings and TRI data is posted on the Internet.

The EMSs evaluated in this pilot project generated new and useful information on the nature and extent of impacts not required by law or regulation. EMSs proved better in providing information on the nature of impacts than on extent. The environmental policy, for example, begins to describe the nature of their impact and a commitment to reduce that impact. Through the aspect and impact identification process, pilots identified local, regional, and global impacts of specific activities, thus providing information on the nature of impacts and in general on the extent of those impacts. Objectives, targets, and performance measures identify commitments to improve environmental protection and progress made towards those commitments. Internally this information is critical to the effectiveness of an EMS. Externally it can improve public understanding of the nature and extent of public health and the environmental

effects of an organization's operation.

Improved access to information is another measure of greater information. The Internet and Annual Reports were seen as new ways for communicating environmental and public health information to the public. Although the pilots (Anheuser – Busch and IBM) consolidated information at the corporate level, considerable information is provided through web sites and annual reports including compliance information, EMS policies, and performance data. In order for these avenues to provide more meaningful public information, local data needs to be included as well as data on specific impacts and commitments for lessening those impacts.

Public involvement in EMSs can indicate greater information sharing. Pilots willingly shared environmental information with the stakeholder working groups including EMS information and performance data. Pilots invited stakeholders into their facilities and provided EMS overviews and facility tours.

One pilot, LM Aero – Palmdale, exceeded the Hazardous Materials Business Plan requirements by giving seminars and plant tours to emergency responders. LM Aero – Palmdale hopes that this information will improve safety by providing emergency responders with first hand information on risks at the plant, rather than emergency responders only relying solely on written Hazardous Material Business Plans.

While significant improvements in environmental communication were observed through the EMS Pilot Project these improvements were limited in either the scope of information or access to that information. Pilots willingly shared EMS information with the stakeholder work groups, which included members of the public; however, the general public did not have this same access. The use of the internet can provide the general public with better access; however, corporate web sites, with the exception of LM Aero – Palmdale, do not provide local facility information. EMSs, however, have the potential for greatly improving the type of information generated and access to that information. Involving stakeholders will be critical in developing information systems that provide relevant and accessible information.

Objective 3: Evaluate economic indicators to determine incentives and barriers to EMS implementation

Although economic data collection was part of the Multi-State Working Group's National EMS database, very few California pilots provided this data. Two pilots, Artistic Plating and LM Aero – Palmdale provided specific economic data. Two other pilots reported anecdotal information on economic costs and benefits.

Economic savings resulting from EMS implementation provides a significant incentive for EMS implementation. These savings are primarily associated with pollution prevention activities that reduced the amount of waste generated or the more efficient use of resources such as water, materials, and energy. However, costs are also associated with EMS implementation. Investments in new equipment, materials, processes, training, consultants and peoples time are all costs that can be a barrier to

EMS implementation. Long term savings may come from initial investments; however, the return on investment may take years to realize and strain the budgets of smaller organizations.

Artistic Plating is an example of a small company that has experienced both economic incentives and barriers in implementing their EMS. Pure economic costs and benefits are discussed in this section. Issues surrounding human resources are discussed in the next section. Table 6 below identifies economic costs and savings resulting from projects implemented as a result of their EMS.

The elimination of perchloroethylene cost $130,000 in initial implementation and will save in the range of $9,500 to $10,500 per year in decreased air sampling costs, decreased medical and biological monitoring, savings in testing and lab analysis, decreased disposal costs, and reduced air quality factor emission fees. In addition, Artistic's insurance company intends to reduce workers compensation insurance premiums.

Improving the quality of wastewater leaving their facility was an objective of Artistic's EMS. This was accomplished through increased water testing and lab analysis at a cost of $2,000 per year for total chromium, $4,500 per year for cyanide, and $2,000 per year for copper. A third stage tank with mixer and controls was added at a cost of $10,000. These actions have helped Artistic stay within permitted limits and save $42,000 per year from reduced liquid chlorine usage and $6000 per year from other reductions in other wastewater treatment materials.

Nitric acid cost savings of $360 per day were realized through the reduction of plating rejects. Costs from nitric acid use in the year 2000 came from treatment of spent triacid (70% nitric acid) totaling $1,050 per week in additional costs, as well as $450 in added caustic soda costs per week. In 2001, nitric acid costs have been reduced by $750 per week through the testing of various substitutes.

Decreased sludge volume led to savings of $18,896 per year in disposal costs and $2,500 savings in reduced quantity of testing and lab analysis required. These savings justified the hiring of an additional treatment operator in April 2001 at $26,000 per year.

As indicated by the data, there is a positive trend in cost savings as a result of EMS implementation. EMS implementation quickly resulted in a $116,896 per year net savings. Projected over a 10-year period this saving translates into $1,028,960[22], after deducting one time costs (see Table 6).

[22] Costs and benefit data were provided by Artistic staff.

Table 6: Artistic Plating Economic Indicators: costs and savings; one time, per year, and projected over a 10 year period.

Item	Costs	Savings	10 year projection
Elimination of Perchloroethylene	$130,000 one time	$10,000 per year	- $30,000
Increased lab analysis for chromium	$2,000 per year		- $20,000
Increased lab analysis for cyanide	$4,500 per year		- $45,000
Increased lab analysis for copper	$2,000 per year		
Third stage tank	$10,000 one time		- $10,000
Reduce liquid chlorine usage in waste water treatment		$42,000 per year	+ $420,000
Reduction in other waste water treatment materials		$6,000 per year	+ $60,000
Reduction of plating rejects (nitric acid savings)		$94,000 per year	+ $940,000
Nitric acid costs: spent triacid and caustic soda	$78,000 per year	$39,000 per year	- $390,000
Decreased sludge volume		$18,896 per year	+ $188,960
Reduced sludge testing		$2,500 per year	+ $25,000
Total	$86,500 per year $140,000 one time	$203,396 per year or $116,896 per year net savings	+ $1,168,960 or $1,028,960 after deducting one time costs

LM Aero – Palmdale is the other facility providing economic data. LM Aero – Palmdale has reduced its annual environmental program costs (i.e., costs for waste disposal, air and water treatment systems, laboratory analysis, and environmental fees and taxes) by over $1 million per year (or 54%) between 1992 and 1999. These costs went from $2,157,000 in 1992 to $1,057,000 in 2000. Total savings during the eight-year period were $7,249,000.

LM Aero – Palmdale has emphasized economic performance in their EMS. Economic feasibility is a stated requirement in their Environmental Policy in order to prevent pollution, conserve resources, reduce waste, and recover or recycle resources. Economic performance is also included in two of their EMS objectives. LM Aero – Palmdale set out to save $2.1 million in environmental costs between 1996 and 1999 by establishing the Lean Enterprise Goal. Using a 1994 baseline cost savings in 96, 97, 98 and 99 totaled $2,281,953. A goal to manage worker's compensation programs to maintain zero cost growth in spite of increasing provider and indemnity rates was not successful. Total costs increased 73 percent over 2000 due to a single expensive non-occupational claim. The cost savings reported by LM Aero – Palmdale and their

performance towards goals demonstrates that environmental protection and cost effectiveness are not mutually exclusive.

Although other pilots did not report quantitative economic data, they did provide qualitative findings on the economic performance of their EMS. While Pentel does not track the full costs and benefits of its EMS, the facility contact estimates that cost savings thus far from energy, waste, and material reductions have covered the expense of retaining the consultant and auditor as well as creating the new system and its processes. A-BI states that the implementation of the EMS led to decreases in energy costs, water and wastewater expenses, carbon dioxide costs, landfill dumping and transportation fees, hazardous waste disposal fees, and ammonia purchases. In addition, A-BI reports decreases in insurance costs and environmental liability and workers compensation costs.

No specific data was provided on the costs of developing and implementing their EMS; however, costs are often associated with the hiring of consultants, third party auditors, and implementing process and procedural changes in operation. Another cost is associated with the many hours employees spend in developing the elements of an EMS, thus taking them away from other responsibilities. Employee training is another cost to the organization.

Summary

The potentially significant cost savings resulting from EMS implementation can provide incentive for organizations implementing EMSs. LM Aero – Palmdale saved over one million dollars per year between 1992 and 1999. Artistic Planting is projected to save $116,896 per year due to EMS implementation. These savings primarily result from increased efficiency in the use of resources and materials. Water, energy, materials and waste all have economic costs associated with them.

EMSs also require economic investment. Although specific costs were not provided, EMS implementation required a considerable amount of personnel hours and could include consultant fees. EMSs could also highlight the need for spending on new processes and operations. Long pay back periods could act as a barrier to EMS implementation, especially for small companies. The Artistic Plating example, however, indicates that substantial savings can occur quickly and accelerate pay back of investments.

Objective 4: Identify challenges and successful examples of EMS implementation.

The purpose of this objective is to gain a better understanding of the difficulties organizations face in implementing EMSs and highlight practices or situations, which tend to promote successful EMS implementation. This analysis draws on examples taken from the Pilot Project Reports as they addressed this objective and other pilot specific objectives. Pilot specific objectives are in addition to the primary objectives of the EMS project. These objectives address unique learning opportunities presented by the different pilot projects and are listed in Section 2.0 of the Pilot Project Reports. This

analysis helps in understanding 'how' an EMS can improve public health and environmental protection.

For this analysis challenges and successes have been grouped into several topic categories. Each category may include both challenges and successes.

Leadership and Commitment

Based on the experience of several pilot projects, leadership in terms of the presence of a champion and the commitment of management is critical to successful EMS implementation. A champion is someone who strongly believes in the benefit of an EMS and will work hard to ensure that one is implemented. Below are two examples of leadership leading to successful EMS implementation, however, other pilots also had very capable people leading, supporting and cheering on the successful implementation of their EMS.

A key to EMS implementation at Artistic is the on-site presence of the Health and Safety Manager, Ruben Angel, who is personally committed to successful EMS implementation at Artistic. Artistic's management has provided financial support for many EMS projects including the replacement of perchloroethylene with an aqueous based cleaner.

At San Diego Chris Toth, Division Deputy of O&M Division provided frequent and effective communication to the organization about rising to the challenge of implementing the ISO 14001 EMS. He was quick to point out how small the gap was between where they were and where they needed to go and how much more they could achieve together by closing the gap. He constantly reminded people that they were in the business of the environment and while the vocabulary was new, the requirements were consistent with current objectives and practice, only perhaps more systematic. The Environmental Management Representative, Linda Jones, was an extremely effective and trusted communicator with people on a face-to-face and one-to-one basis as they received training, provided feedback, and completed the required Standard Operating Procedures and work instructions necessary for successful implementation. Additional champions were found in designated facility environmental and energy coordinators as well as volunteer recycling coordinators.

At CMSA, however, inconsistent commitment and leadership has resulted in challenges to implementation. The CMSA EMS Steering Group was originally led by an individual who was an avid believer in the potential for systematic environmental improvements to be identified and realized through the EMS process. The Steering Group was initially successful in accomplishing the first phase of the EMS process, but their growing commitment to the program also required incremental increases in funding, human resources, and a push to evolve the culture of the facility. Based on competing priorities, CMSA management had recommended to its board of directors that it authorize a slowdown of EMS implementation. Several people spoke out against this idea at a board meeting, including Local Advisory Committee members, and the board overruled management by requiring that EMS implementation continue as planned.

Strains on Resources

The economic and human resource requirements can be a challenge to EMS implementation, especially for small and medium sized companies. The Sonoma County Wineries and Artistic Plating illustrate this challenge. Davis Bynum and Benziger are small companies and were challenged by the amount of time required to develop an EMS. The wineries were not able to involve more than a few people on the EMS development team. Broader inclusion of winery functions would provide more balance and greater employee buy-in to the EMS. Artistic Plating experienced difficulty in maintaining focus to assure continual improvement of their EMS. Specifically, the facility's EMS champion has diverse responsibilities, and global environmental and health and safety responsibilities had not been distributed to other personnel. Artistic has recognized this difficulty, and is now distributing more EMS responsibilities to other employees, as well as reassigning some of the production and personnel related duties which the Health and Safety Manager had been given.

Pentel demonstrates that resource pressures are not just felt by small companies. Involving all Department managers in identifying environmental aspects and impacts as well as evaluating their significance was a time consuming process that was initially resisted by many managers. However, the process eventually resulted in the greater understanding, acceptance, and support of the EMS by the managers, which was needed for their involvement.

Technical Complexity and Assistance

Implementing EMSs can be technically challenging for any size organization. Technical challenges can differ from small companies to larger ones, as well as the ability of an organization to overcome these challenges. Technical challenges are related to resource strains in that time and money can often resolve technical issues.

The two wineries demonstrate technical challenges for small companies. The aspect and impact element of the EMS was especially challenging and time consuming. Implementing operational controls like Standard Operational Procedures are not only time consuming, they require a technical understanding of processes. EMS development was a 'learn by doing' exercise. Cal/EPA provided some technical assistance by providing coaching, training and information resources. EMS models, examples and templates were useful resources. The Australian Agricultural EMS template and the US EPA Merit Partnership Metal Finishing template were used extensively for this project. Also, training classes provided by Cal/EPA to the Working Groups and pilot project greatly helped the team develop the EMSs.

Artistic Plating is another Small to Medium Sized Enterprise (SME) that struggled with the technical aspects of an EMS. Artistic representatives state that use of a US EPA sponsored industry-specific EMS template was helpful in developing the EMS, providing suggested aspects and impacts, compliance checklists and much needed organization and structure. Participation in an industry-specific US EPA sponsored EMS workshop series with eight other metal finishing companies also helped Artistic through group learning and building on each others' ideas, as each company developed its own EMS

and shared their insights. Onsite contractor assistance from the workshop instructors helped Artistic with EMS implementation of objectives and targets, and fleshing out EMS documentation details.

As illustrated by the above two examples, technical assistance form government can help overcome economic and technical barriers to EMS implementation at small and medium sized enterprises (SMEs). Other government assistance included EMS training for CMSA and four educational workshops for pilots and stakeholders participating on the Working Groups. Both of these were supported by US EPA grants.

IBM and Pentel provide examples of the challenge of balancing the need to create new systems with keeping things manageable. Pentel has tried to select metrics that adequately measure and communicate environmental impact reduction without creating onerous monitoring and reporting requirements in addition to business-related metrics already in use. A challenge identified by IBM in establishing its ISO 14001 EMS was assuring that processes required for maintenance of the EMS registration were designed with minimal complexity to assure efficient implementation. These included document control and internal auditing programs.

Integration into Organization

The ability to integrate the EMS throughout an organization appears to be critical to its success. Integration can be thought of as applying the principles of the environmental policy to the many business functions of the organization through education and implementation programs.

LM Aero – Palmdale's ability to integrate EMS and its philosophies into every aspect of their business has greatly contributed to its success. Stressing that environmental health and safety is everyone's responsibility has helped make the integration successful. According to Michael Haro, Manger of Environmental Resources, "Integration is about making environmental, health and safety real for everybody else in the company." The 6S program and Job Hazard Analysis (JHA) illustrate EMS integration.

The six "S's" of the 6S program are Sort, Straighten, Shine, Standardize, Sustain, and Safety. Originally developed in Japan as a manufacturing housekeeping and efficiency program called 5S, the 6S Program has been successfully applied at LM Aero—Palmdale to work more efficiently, reduce waste, conserve resources, prevent accidents and maintain compliance. Through the 6S program, LM Aero has successfully integrated environmental safety and health priorities into manufacturing activities.

The Job Hazard Analysis is an example of an integrated program that meets several objectives. The goal of the JHA program is to evaluate both environmental and worker safety for every major shop, lab, and work area. The JHA project is a single report that lists all significant hazards in an area; environmental, safety and health controls; and training requirements for the work area. The completed JHA is given to the supervisor/manager of the area who must sign the form, post it in the affected area, and

inform employees of the results. The JHA has improved the quality of information going to employees by providing a "simple summary" of all the hazards of an area and what must be done to protect the worker and the environment. The JHA also provides valuable feedback to ESH staff and contributes to the continual improvement process of their EMS. Through the JHA, new environmental aspects and impacts can be identified as well as their risks and significance.

A specific example of pollution prevention integration into business and design processes at LM Aero – Palmdale is the Joint Strike Fighter (JSF). Pollution prevention was considered from the initial design discussions, and pollution prevention technologies developed for the F-117A Stealth Fighter, F-16, and F-22 were incorporated into the design of the JSF. Only fifty-four hazardous materials are used to support the JSF concept demonstrator aircraft, whereas four to five hundred hazardous materials are typically found in predecessor production aircraft.

Training is another means of integrating the EMS into the activities of employees. At Anheuser Busch, training to increase workers awareness of how their behavior impacts the environment appears to be of significant importance in improving the facility's environmental effect. After training, A-BI employees have a better understanding of the EHS consequences of not performing their job correctly. Employees also understand they are empowered and have the authority to perform their jobs in the most EHS-friendly way.

Sometimes integration extends beyond the doors of the facility. IBM helps to ensure that the Environmental Policy objectives are met by their suppliers through substantive environmental evaluations for a certain subset of its suppliers. Although it is neither feasible nor appropriate for IBM to evaluate all of its thousands of suppliers, the company does so for certain production-related suppliers, based upon the degree of environmental risk inherent in their operations and the extent to which their work is unique to IBM. The objective of these evaluations is to assess whether the suppliers have a good focus on environmental management, including complying with laws and regulations and through sound management practices.

The San Diego EMS experience provides a model for further integrating the EMS into other operations as experience and success are gained. The initial EMS ISO 14001 certification at the Metropolitan Waste Water Department applied to the Operation and Maintenance Division. Other divisions are now pursuing certification and eventually MWWD will be certified. Certifications are being pursued by the Collection Division (certification scheduled for May 2003) and the Environmental Monitoring and Technical Services Division (certified June 2002). An important lesson from the O&M Division's experience is to start where success is likely and build. This approach reduces the risks of failure of the innovation and increases the ability of the organization to learn by doing.

Pilots with fully implemented EMSs, like LM Aero – Palmdale, IBM, ABI, Pentel and San Diego were able to successfully connect the different elements of their EMS (policy, aspects, objectives, programs, communication, measurement, review, corrective action,

and continual improvement) into a consistent and integrated system that works to implement the environmental policy of the organization. This means, for example, that identified aspects are consistent with the scope of the EMS as defined in the policy. Objectives and programs are designed to manage or minimize impacts of significant aspects. Personnel are properly trained in order to minimize impacts and achieve objectives. Management of significant aspects is measured and audited with respect to legal and other requirements. Performance towards objectives is measured. Management reviews performance and audit reports and directs corrective action to address deficiencies. Environmental protection is continually improved through system adjustments and the achievement and resetting of objectives. These pilots were able to achieve this integration through effective communication networks.

On the contrary, pilots with EMSs still in development or partially implemented like CMSA, Davis Bynum and Benziger have not been able to thoroughly connect various elements of their EMS. CMSA, Davis Bynum and Benziger have yet to develop programs to meet objectives, monitor progress, audit results, review performance and make corrections to their systems. Limited performance improvements are observed at these pilots. Although Artistic has implemented their EMS and has seen positive performance results, some compliance issues observed at Artistic are in part attributed to production pressures and a lack of adequate operational controls. Operational controls were not included in the Metal Finishing EMS Template used by Artistic in creating their EMS. Operational controls appear an important part of a fully implemented and integrated system. Also, system audits have not yet been conducted at Artistic.

Goal Setting and Performance Feedback

The process of setting performance goals, measuring progress towards those goals, and taking corrective action when needed are important elements in creating improvements in public health and environmental protection. This also describes the 'continual improvement' nature of an EMS. Through goal setting and performance feedback and continual improvement, pilots were able to achieve significant pollution prevention gains. Below are several examples how EMSs were successful in improving public health and environmental protection.

At San Diego, reduction in potable water use was achieved by increasing organizational focus brought about by target setting and resulted in improvement in communication between employees and management facilitated by performance reporting and management review. While it was recognized by facility management at the Metropolitan Biosolids Center that the quantity of reclaimed water in proportion to potable water used for facility processes was far lower during operation than had been intended by design, the reason behind the discrepancy remained undiscovered until potable water use reduction was identified as an EMS target. To resolve the discrepancy, design and construction blueprints as well as past construction managers were consulted. It was discovered that a major valve in an underground pipeline which ties Metro Biosolids Center to the North City water reclamation plant had been left partially closed. Once the valve was opened, the Metro Biosolids Center was able to

make use of the available reclaimed water—utilizing 97% reclaimed water. Division management credits the focus facilitated by EMS requirements with the improvement in communication and resulting decrease in problem resolution time.

Another example from San Diego is their paper recycling program. Improvement in the paper recycling program that existed prior to the EMS came directly from implementation of the plan, do, check, adjust cycle of continual improvement required by an EMS—specifically, the "check" requirement. During an internal EMS audit, it was discovered that separated paper was not being transported to the paper recycling contractor as intended, but was being transported directly to the landfill by an O&M Division employee. The separated paper had been continually refused by the recycling contractor due to excessive contamination, in response, the employee, began taking the paper directly to landfill. Once management was made aware of the problem, improvements were made to reduce contamination and paper is now recycled as intended.

IBM provides an example of how objective setting, measurement and corrective actions are carried out. IBM's San Jose facility measures its performance against established objectives and targets in various ways, depending on the specific objectives and targets. Progress towards achieving the facility's established targets is reviewed periodically. This review is either done monthly, quarterly, or at some other frequency established by the facility personnel who are responsible for meeting that objective and target. These reviews may take the form of a report to Corporate Environmental Affairs, site management or review by other responsible personnel. Whichever mechanism is used, the individual responsible for achieving the target is also responsible for ensuring that the target is met within the identified time frame.

External Stakeholder Involvement

External stakeholder involvement is important to the ability of an EMS to improve both environmental protection and the amount of information provided to the public. The CMSA EMS community involvement process illustrates the role outside stakeholders can have in EMS implementation. The Local Advisory Group, composed of interested parties from the water industry, local environmental organizations, State government, and local academia, was created as a resource for conveying the progress of the EMS to the public and as a venue for receiving feedback on the EMS from interest groups. The LAG has been effective at drawing attention to issues that CMSA may have overlooked but are significant to the public, such as increased disclosure of environmental impacts, and they have been a powerful stimulus in generating progress in the EMS program. The LAG was also the motivation behind maintaining the EMS program at CMSA when upper-level management sought to dissolve the program. The LAG has become a representative for the public and an active participant in CMSA's EMS program to voice their concerns. The LAG has definitely had a significant and powerful impact on the EMS program at CMSA.

Engaging local stakeholders, however, can be a challenge. Stakeholders are often volunteers or members of non-government organizations with competing priorities and

limited resources. LM Aero – Palmdale has had a local advisory committee for several years. They report difficulties in engaging stakeholders in a way that significantly effects their EMS.

Summary

Challenges and success of EMS implementation were observed in several areas including leadership and commitment; strains on resources; integration of EMS into the organization; technical complexity and assistance; goal setting, measurement and feedback; and stakeholder involvement. Challenges can be thought of as barriers or inhibitors of improved environmental protection. Successes demonstrate activities that promote improved environmental protection. Table 7 below summarizes promoters and inhibitors of EMS implementation.

Table 7: Promoters and Inhibitors of EMS Implementation

Promoters	Inhibitors
Strong management commitment to EMS implementation and improved environmental protection.	Weak management support of EMS implementation and acceptance of status quo in environmental protection.
The presence of champions, in either management or staff.	Apathy or resistance to EMS implementation in management or staff.
Financial and personnel resources to develop and implement an EMS.	Limited financial or personnel resources to develop and implement an EMS.
Involvement of personnel from all parts of the organization in EMS development.	Few personnel involved in EMS development.
Broad scope in the evaluation of environmental impacts.	Narrow scope in the evaluation of environmental impacts.
Stretch goals for improved environmental protection.	Easily attained goals for improved environmental protection.
Use of communication tools as feedback mechanisms to inform members of requirements, report performance, and implement system adjustments.	Incomplete feedback mechanisms due to poor communication systems.
Technical expertise either in house or from outside consultants.	Limited technical expertise.
Availability of tools (training, templates, and guidelines) to assist in EMS development and implementation.	Few tools to assist in EMS development and implementation.
Involvement of outside stakeholders either from the government, other businesses (industry associations), or the community.	Isolated development and implementation of the EMS.
Determination to break through limits to environmental improvements through technical, economic, or cultural change.	Limits to environmental improvements resulting from technical, economic, or cultural factors.

IX. Conclusions and Recommendations

Objective 1: Determine whether and how the use of an environmental management system (EMS) by a regulated entity increases public health and environmental protection over their current regulatory requirements.

Conclusions

1.1. EMSs Can Have a Positive Impact on Environmental Protection

The data collected during the EMS pilot project supports the conclusion that EMSs *can* have a positive effect on environmental protection and increase protection above that provided by a regulated entity's current regulatory requirements. Improvements were observed in each of the three sets of indicators of improved environmental protection measured in the pilot project: awareness and commitment, systems management of environmental impacts, and performance of key environmental indicators. Environmental performance improvements indicate that EMSs can be an effective pollution prevention (P2) tool.

Improvements in environmental protection were measured three ways. First, a pilot may perform greater than legally mandated emission requirements (e.g. permitted air or water emission levels). Second, a pilot may mitigate environmental impacts not covered by law and regulation. Third, a pilot may improve its level of environmental protection above that provided prior to EMS implementation. The first two measures are consistent with AB 1102 (Stats. 1999, Ch. 65) PRC § 71045 et seq., while the last measure is needed to understand whether an EMS in helping change the level of environmental protection at an organization.

Environmental policies demonstrated "Awareness and Commitment" that went beyond simply meeting regulatory requirements. Aspect and impact identification uncovered several areas needing better management that lay outside of the regulatory arena. Objective and targets specifically identified commitments and showed that progress is being made in meeting these commitments. Better systems for environmental protection emerged from EMS implementation including operational controls, training, communication, audits, management review, and corrective action. Pilots were able to achieve significant pollution prevention gains through EMS implementation. For example, environmental performance improvements were seen in non-regulated activities like energy and water conservation, and waste reduction. Gains were also observed in regulated hazardous waste generation.

Pilots performed well in comparison to regulatory requirements. Pilots demonstrated performance exceeding regulatory limits. However, only Artistic set specific objectives to improve performance beyond regulatory limits. The EMS was responsible for improved compliance with regulatory standards at Pentel. IBM demonstrated performance well beyond regulatory limits, but because their EMS evolved over many years it was difficult to attribute performance in regulated areas to their ISO 14001 certified EMS. Most pilot projects improved environmental protection in areas of significant environmental impact that are not addressed by regulation or law.

1.2. A Systems Approach Towards Environmental Management Yields Results

Part of the primary objective of the EMS Pilot Project was to determine how an EMS improves environmental protection. The simple answer is that EMSs help an organization apply sound management systems to environmental issues and integrate environment into the business decision making structure. This is accomplished through taking a 'systems approach' to environmental management that is roughly outlined by the "Plan-Do-Check-Act" cycle. This cycle establishes a system that can affect the culture of an organization and help drive continual improvement in environmental protection.

The ability of an EMS to affect the culture of an organization is critical in producing improved environmental protection. EMS elements like the environmental policy, aspects and impact identification and setting objectives and targets can act to change awareness and commitment of an organization and thus lead to organizational change. Programs and processes that implement the EMS, such as operational controls, training, pollution prevention, audits and management review act to integrate the spirit of the environmental policy into potentially all business functions of the organization. Processes that 'check' the performance of the system and then 'act' to adjust the system provide positive feedback loops that drive continual improvement in environmental protection. Cal/EPA observed organizational change from cultures of compliance maintenance or avoidance to ones of continual improvement and environmental protection beyond regulatory commitments.

For an organization to successfully implement systems based management of the environment, key elements must be present. Based on the information collected in the pilot project, Cal/EPA has identified the following key elements:

- An environmental policy with commitments to pollution prevention, resource conservation, compliance, public involvement and continual improvement;
- Whole system assessment of environmental impacts and identification of those which are most significant;
- Objective setting for the reduction of environmental impacts;
- Measuring and monitoring of practices and performance which support environmental policy and objectives;
- Operational controls;
- Audits (internal and third party);
- Management review and adjustments in the system to ensure continual improvement;
- Involvement of effective stakeholders; and
- Public reporting of performance results.

1.3. EMSs Require a Foundation of Enforceable Standards

While the pilot projects' EMSs demonstrated increased environmental protection, an EMS cannot guarantee environmental protection beyond an organization's regulatory requirements. Further, the presence of an EMS cannot ensure regulatory compliance. The role of an EMS, in the regulatory context, is to help the organization meet its legal requirements. In no way should an EMS be viewed as or considered as a replacement for mandatory and enforceable regulatory standards. On the contrary, well functioning EMSs demonstrate the need for clear operating instructions, audits, corrective action and continual improvement. Laws and regulations provide external operating requirements while regulatory inspections and enforcement provide external audits and mechanisms for corrective action. Further, meeting regulatory compliance requirements often motivates EMS implementation and many EMS elements (environmental policy, education, operational control, audits and corrective action) are directed towards meeting regulatory standards.

Enforceable standards are essential to public health and environmental protection in California because they set the minimum expected level of behavior. Regulatory standards are effective motivators of performance. Regulatory review of an organization's performance is critical to the continued protection of public health and the environment as well as the successful operation of an organization's EMS.

1.4. EMS Can be a Tool for Sustainable Development in California

The central characteristics of an EMS make it a potential tool for enabling sustainable development in California. The ability of EMSs to affect cultural change in an organization and establish a process of continual improvement toward environmental goals can be used to help direct improvements in California's environment, economy and quality of life. By taking a systems approach to environmental management, EMSs have demonstrated that integrated and goal based environmental management achieves results. Economic and social goals can easily be incorporated into the EMS structure. EMSs have already demonstrated economic benefits. Environmental efficiencies translate into economic efficiencies, which translate into investment and job creation. EMSs can help create sustainable businesses. The stakeholder partnerships created or evaluated in the EMS Pilot Project demonstrate the potential effect EMSs can have on communities through establishing and building relationships and a common sense of purpose.

Recommendation

1.1. Government, in consultation with the public, business, and academia, should find ways to use EMSs as a tool for the further and continual improvement of public health and environmental protection.

Now that the potential benefits of EMSs have been demonstrated and an understanding of how improved protection is achieved, the next step is to determine how to best harness EMSs in the service of improved public health and environmental protection. Three actions are recommended to develop EMS as a tool for improving public health and environmental protection.

A. Convene Sustainability Partnerships

Begin by applying a systems approach to environmental management for larger organizations, including industrial sectors or geographic regions, by establishing voluntary partnerships. The goal of these partnerships would be to establish a system of continual improvement in public health and environmental protection within an industrial sector or region. The partnerships would embark on a plan-do-check-act process designed to address significant and persistent environmental problems. These partnerships should also address the other elements of sustainability including economic wellbeing and social equity and strive to establish sustainability as a basis for planning and decision making.

B. Use recognition and performance targets as drivers and incentives for improved environmental protection

EMSs use the objective and target process to drive improvements in environmental performance. Government should explore using this fundamental process of an EMS as a tool for driving environmental performance towards publicly created environmental targets. These targets can either be voluntary or legally mandated. Legally mandated schedules for performance improvements, or targets, have been used successfully in the past and should be used in the future. EMSs may help organizations comply with these targets. Stakeholder partnerships, like the one described in the above paragraph, may also establish voluntary performance targets. The continual improvement nature of an EMS can help move organizations along a path towards meeting performance targets. Individual organizations can align their system of setting and meeting objectives and targets with externally created targets. Incentives for meeting voluntary targets could include recognition of 1) EMS implementation; 2) agreements to work towards targets; and 3) achievement of performance targets.

C. Explore Regulatory Track for High Performing Organizations

Once experience working with EMS in a regulatory context is gained after implementing the above recommendations, an exploration of a more formal regulatory track for the highest environmental performing organizations might be warranted. Many states and nations are establishing such tracks and California can benefit and learn from their experience. The following criteria must be met should a complementary regulatory track be established in California.

a) Compliance with all applicable regulatory standards must be assured. A complementary or alternative regulatory pathway cannot be used as a means to "backslide" on existing standards. Preference should be given to systems that would achieve performance significantly beyond that required by existing law. The determination as to what is "significantly beyond" would be part of the future vetting process. Consideration could be given to different process standards, i.e. how performance is achieved; however, the legally required level of performance should not be compromised.

b) Information accessible in the public domain should not be degraded, but enhanced. As in the recommendation above, preference should be given to systems that lead to higher quality information received by the agencies and the public, and to systems that produce this information more efficiently and effectively.

c) The system should be of significant value to the agencies, the public, and the regulated community. This means that by using simpler, more efficient means to produce better environmental results and information, both sides of the regulatory transaction benefit. Communities must also benefit in the way of improved protection, or quality of life. Without this mutual benefit, an alternative track will fail.

Objective 2: Determine whether and how the use of an EMS by a regulated entity provides the public greater information on the nature and extent of public health and environmental effects than information provided by their current regulatory requirements.

Conclusions

2.1. EMSs Generate New and Useful Information about the Nature and Extent of Public Health and Environmental Impacts

The EMSs evaluated in this pilot project generated new and useful information not required by law or regulation. Environmental policies, aspects and impacts, and objectives and targets were created as a result of EMS implementation. These EMS elements provide new and potentially useful information about the nature of public health and environmental effects of the pilot's activities because they illustrate the pilot's awareness and understanding of risk and their commitment to control, reduce or eliminate risk. Internally, this type of information is important to the operation of the EMS by providing specific direction through policy, increased knowledge of impacts and responsibilities, and indicators to measure performance. Externally, this information can provide the public with greater understanding of the nature of risks and the actions being taken to mitigate those risks. EMS information also, at least qualitatively, provides information on the public health and environmental effects of the organization's operations by identifying impacts that are local, regional, or global.

Significant improvements in environmental communication were observed through the EMS Pilot Project. Pilots willingly shared environmental information with the stakeholder Working Groups, which included members of the public. Information included policies, impacts, objectives and targets, implementation programs and performance data. Pilots invited stakeholders into their facilities and provided EMS overviews and facility tours. Stakeholder groups did influence EMS development at CMSA and the Sonoma County Wineries. One pilot, LM Aero – Palmdale exceeded the Hazardous Materials Business Plan requirements by giving seminars and plant tours to emergency responders. Environmental information was also posted on corporate web sites. Improvements in environmental information, however, were sometimes limited in either the scope of information or access to that information. Pilots willingly shared EMS information with the stakeholder work groups; however, members of the general public did not have the same access. The use of the internet can provide the general public with better access; however, corporate web sites, with the exception of LM Aero – Palmdale, do not provide local facility information.

2.2. Potential for Improved Sharing of Environmental Information with the General Public not yet realized.

Environmental information generated by a pilot's EMS is usually organized in ways that make the information relevant and accessible. However, this information is generally used for internal purposes, or made available to the public only on request. With the exception of the Cal/EPA sponsored stakeholder Working Groups, environmental performance information generated by the pilots was not usually shared with the general public. The Internet and Annual Reports were seen as new ways for communicating environmental and public health information to the public. Although the pilots that used these media for information sharing consolidated information at the corporate level, considerable information is provided including compliance information, EMS policies, and performance data. In order for these avenues to provide more meaningful public information, local data needs to be included as well as data on specific impacts and commitments for lessening those impacts.

Recommendation

2.1. Government can support environmental information sharing with the public and recognize efforts to share information

EMSs provide an excellent structure for gathering information. Government can help make environmental information available to the public, such as information on environmental impacts, targets for improvement, and progress towards goals. Improved information sharing could be one criterion for public recognition of environmental efforts and part of industrial sector or regional EMS approaches.

The type of information generated by EMSs may be valuable to both environmental agencies and communities. Communities or non-governmental organizations could use the information to track environmental issues important to them and provide feedback to both regulatory agencies and to the organization with the EMS. Therefore, EMSs have the potential of establishing performance enhancing communication systems between industry, communities, and government. Stakeholders must be involved in establishing these systems.

Government could explore developing a reporting approach for organizations with EMSs, which meet multiple agency requirements in a consolidated fashion. In this way, government may improve access to relevant environmental performance data, recognize accomplishments, and make reporting requirements more efficient.

Objective 3: Evaluate economic indicators to determine incentives and barriers to EMS implementation.

Conclusions

3.1. Economic Incentives and Barriers are both Present in EMS implementation.

The potentially significant cost savings resulting from EMS implementation can provide an incentive for organizations implementing an EMS. LM Aero – Palmdale saved over

$1 million per year between 1992 and 1999. Savings are attributed to reductions in generation of hazardous waste, demand on air and water treatment systems, need for laboratory analysis, fees and taxes. Artistic Planting is saving $116,896 per year due to EMS implementation. These savings primarily result from increased efficiency in the use of resources and materials. In general, economic savings and efficiency can result from EMS implementation. Establishing performance objectives and improving operational control can help increase efficiency and save money. Water, energy, materials and waste all have economic costs associated with them.

EMSs also require economic investment. Although specific costs were not provided, EMS implementation required considerable amount of personnel hours and could include consultant fees. EMSs could also help prioritize spending on new processes and operations. Long pay back periods could act as a barrier to EMS implementation, especially for small companies. The Artistic Plating example, however, indicates that substantial savings can accelerate return on investment.

3.2. Limited economic data on costs and benefits is available from organizations implementing EMS.

Only two pilots provided economic data on the costs and benefits of EMS implementation. Further, the data provided was limited especially when identifying costs of EMS implementation. Greater and more complete economic data can be helpful in motivating other organizations to implement EMSs.

Recommendations

3.1. Economic planning tools should be included in EMS assistance tools including guidelines and templates.

Although many costs saving can result from EMS implementation, EMSs can also be expensive undertakings. Economic planning may help organizations decide whether EMS implementation is economically feasible. Tools that assist organizations in making the business case for EMS implementation should be included in any EMS template or guideline.

3.2. Government can help collect and distribute economic data on EMS implementation.

Government can be a clearing house of economic data on EMS implementation. In order to allay concerns over sharing sensitive economic data, the data could be made available while protecting the identity of the individual organizations. Academia may play an important role in studying the economic costs and benefits of EMS implementation. Further, better tools for measuring these costs and benefits need to be made available to organizations.

Objective 4: Identify challenges and successful examples of EMS implementation.

Conclusions

4.1. Small and Medium Sized Enterprises (SMEs) May be Especially Challenged in Implementing EMSs

The economic and human resource requirements of EMS implementation can be a challenge to any organization; however, this is especially true for SMEs. Smaller organizations may also lack the resources to overcome technical challenges of EMS implementation. Government involvement helped Benziger, Davis Bynum, CMSA and Artistic, all SMEs, overcome barriers to EMS implementation.

4.2. Leadership and systems approaches are important for successful EMS implementation

Similar characteristics were observed in pilots with successful EMSs. These characteristics include leadership qualities like strong management commitment and the presence of one or more champions. Another characteristic is the extent to which system approaches are applied to the EMS. This includes integration of the EMS into all elements of the organization's activities and the establishment of information feedback loops which drive continual improvement through audits, performance monitoring and corrective action.

Recommendation

4.1. Government Support for EMS Implementation Could Improve Public Health and Environmental Protection and Information Sharing.

As the protector of the public good, government has a special role in supporting EMS development. Government's interest in supporting EMSs should be based on a desire to improve environmental protection and information to the public. This report has concluded that EMSs can have a positive effect on environmental protection; therefore, EMSs should be viewed as a viable and potential tool for increasing environmental protection. Below are some of the ways government can support EMS development and improve environmental protection.

- Provide tools such as templates or EMS implementation guides.
- Provide grants for the development of tools for a particular industrial sector.
- Establish partnerships between industry, government and community stakeholders in order to increase the flow of information about environmental impacts and protection.
- Establish goals for regulated and non-regulated environmental impacts. Either voluntary or mandatory, these goals could influence EMS objective setting.

- Recognize companies operating in excess of regulatory standards. Public recognition could be based on the implementation of an EMS, compliance with environmental laws, the sharing of environmental information, and progress towards government-accepted goals, or achievement of government-accepted goals.
- Provide resources to help organizations break through barriers that may limit environmental improvement.
- Establish standard public reporting guidelines.
- Include increased public reporting in environmental recognition programs.

Appendices

Appendix A: Anheuser Busch, Inc. Fairfield Facility Pilot Study Report
Appendix B: Artistic Plating Pilot Study Report
Appendix C: Central Marin Sanitation Agency Pilot Study Report
Appendix D: San Diego MWWD, O &M Division Pilot Study Report
Appendix E: IBM Pilot Study Report
Appendix F: LM Aero – Palmdale Pilot Study Report
Appendix G: Pentel of America Pilot Study Report
Appendix H: Wineries Davis Bynum and Benziger Family Pilot Study Report
Appendix I: Pilot Projects' Environmental Policies
Appendix J: Public Resource Code 71045(Assembly Bill 1102)
Appendix K: California Data Protocols